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THE NEED FOR AN INTERNATIONAL UNIT OF LUMINOUS INTENSITY.

When the Illuminating Engineering Society was formed, it was announced that one of its objects was to bring about uniformity in the standards and units employed in measuring illumination. Although the greater number of papers presented and discussed by this society have had to do with subjects of more immediate practical importance, the necessity for placing the science of illumination on a more scientific basis, and of bringing about an international agreement regarding the fundamental units has been discussed at various times. But the most important action taken was the formation of an international committee on nomenclature and standards, the duties of this committee being to consider thoroughly the best way of starting the work so urgently needed, and, when it seemed advisable, to make such suggestions as would tend to place the science on a basis comparable with others such, for example, as electrical science.

The work outlined for this committee is heavy, because on the one hand there is a confusion in the use of terms, and on the other there is an unfortunate lack of agreement on the unit of luminous intensity, which is in one sense the fundamental and hence the most important of all the units. There is not only a difference in this respect among the different lighting interests in this country, but the units employed here are not those used in other countries.

The first great step towards putting the science on a secure and international basis seems, therefore, that of adopting an international unit of luminous intensity which shall be used in all civilized countries.

The great need for this is shown by the following statement of the present situation. In this it will be noticed that several of the units in use differ from one another but little. This is, of course, an advantage when it comes to abandoning them for one international unit, but it is a disadvantage until such unit be adopted, because there is then always an uncertainty of the unit employed if this be not specifically stated.

It will be convenient in this review to state the different units employed in terms of one, and the one used for this purpose is that adopted by the Bureau of Standards at Washington, and which is called the candle. The unit used in the photometry of gas is not accurately fixed in this country, inasmuch as candles are still employed to a great extent. There is, however, a growing tendency to use the pentane lamp. The unit obtained from this lamp in the United States is probably about

0.95 to 0.98, though the ratio to the candle unit of the Bureau of Standards is not very accurately known.

In England there seems to be some doubt as to the exact value of the unit, owing to the different ratios obtained between the pentane lamp and the Hefner and Carcel lamps, depending upon whether the comparisons were made directly or by means of incandescent lamps standardized at the different national laboratories in England, France and Germany. The most probable value of the unit as determined by the various measurements made by means of incandescent lamps is about 0.98. If, on the other hand, the various direct comparisons between the three standard lamps mentioned be considered, the value of the unit is about 0.95.

In France the unit is the bougie décimale, which is semi-officially recognized in the photometry of electric lamps. It has a value of about 0.98. In the photometry of gas in France the official unit is the intensity of the Carcel lamp, which is supposed to have a value of about 9.6 bougies décimales.

The unit in use in Germany is the Hefner, which has a value of 0.88 in terms of the unit of the Bureau of Standards.

Looking over the ratios just given, it is seen at once that with the exception of the German unit, the average value of the units of the other three countries will be approximately 0.98 in terms of the present Bureau of Standards unit. This value agrees approximately with the mean value of the two units used in the United States in the photometry of gas and electric lamps, so that a compromise in the interest of international unity will require no greater change of unit than a compromise in the interest of unity in this country, and in neither case will the change in unit be greater than about two per cent, an effect too small to be seriously felt even in the photometry of incandescent lamps where the highest accuracy is attained in commercial testing.

From the close agreement of this average to the value of the French unit, it is certain that the cooperation of France could be secured if it should be proposed as the international unit, and only England and the United States be required to vary their units slightly to bring these three countries into an agreement. As regards this country, the change is desirable in all events, since it has been shown it would bring the gas and electric interests into harmony, and since in England the condition is at present not settled, the change would be slight and could probably be brought about without serious difficulty.

In arriving at this average, which has been suggested as the international unit, the German unit has not been used because it differed so greatly from the other units. There might possibly be an objection on her part to adopting the proposed unit, which would be regrettable since so much has been done in that country to advance the science of photometry, but even in this event, the other three countries might come to some agreement since it could be done at so little inconvenience in the expectation, then, that at some future time a general international understanding could be reached.

Some, no doubt, while admitting the desirability of coming to an agreement upon an international unit of luminous intensity, will be inclined to underestimate the value of such an understanding; to them it may seem that since each country must work out its own problems, a definite and accepted unit for each country is all that is really necessary. They, however, overlook the powerful aid to the art secured by the use of universal units and standard, which, in the present formative stage of industrial photometry, would be of the greatest value.

To bring about such an agreement as suggested, particularly if, as seems likely, this country is to move actively in the matter, it is highly desirable, and we believe it is necessary that the different lighting interests in this country should first be in agreement. Hence the first step would seem to be a conference of those bodies most interested with a view to some definite action. We understand that it is in this direction that the committee on nomenclature and standards will first move. The desirability of this agreement is recognized by all, and it has been shown above that it should not be difficult to reach an agreement since but a slight sacrifice on the part of all concerned is necessary. When this has been brought about, steps toward an international understanding can be taken with good prospects of success.

THE ELECTRICAL STERILIZATION OF SEWAGE.

At a recent meeting of the Boston Society of Civil Engineers an exhaustive paper on "Sewage Purification" was presented by Mr. George W. Fuller, one section being devoted to recent progress in methods of sterilizing sewage. Among these methods electricity has become a most promising means of attacking the problem. Both the ozone and the chlorine treatment were considered. The writer stated that as far as he knew the use of ozone has never been seriously considered in connection with sewage effluents. For water purification there have been two serious drawbacks to its tentative use in Europe, one being the irregularity of its production by the best devices, and the other the cost of its production. Recently the United Water Improvement Company of Philadelphia has claimed that new discoveries by members of its staff enable from sixty-five to eighty grammes of ozone to be produced per kilowatt-hour, which would be a rate four or five times as efficient as heretofore.

In regard to the chlorine treatment it appears that fifty parts per million of free chlorine when applied to a settled sewage effluent will produce sterility, and that an application of five parts per million of free chlorine, acting for two hours, will remove more than ninety-nine per cent of the total bacteria and will practically eliminate intestinal bacteria as indicated by tests for *B. coli*. Mr. W. Pollard Digby, who was connected as electrical engineer with the company which developed the Woolf process in this country and England, has recently made important discoveries as to electrolytic cells for the decomposition of salt solutions. Estimates of the cost per pound of available chlorine are given by Digby and Shenton as ranging

from 8.7 cents to 9.7 cents with electricity at two cents per kilowatt-hour, and salt at $4 per ton.

In a paper by Messrs. Phelps and Carpenter in the January number (1907) of the *Technology Quarterly,* it was stated that available chlorine can be manufactured for about 1.3 cents per pound, according to practices in large paper mills using the McDonald electrolytic cell. Power is figured at 0.6 cent per kilowatt-hour, with a production of 0.46 pound of chlorine per kilowatt-hour. On this basis it is stated that it would cost about eighty-five cents per million gallons to treat sewage effluents with five parts per million of free chlorine. Mr. Fuller states that it is believed that this figure is far below that which would be the actual cost in practice in most cases, especially for plants of small or moderate size. Thus, coal is taken here at $2 a ton, which is possible only in and near the coal regions. The figures should also be increased for charges for labor, both for generating power and for the application to the sewage effluent, and by interest on both power plant and treatment plant as well as the usual item for repairs, renewal and depreciation. It is believed that the Digby and McDonald electrolytic cells note marked steps in advance along the line of improvements required for certain types of sewage-disposal problems.

In the discussion Mr. E. B. Phelps considered the cost of manufacturing chlorine electrolytically, citing as a low rate the purchase price of 1.25 cents per kilowatt-hour obtained for electric power in the motor-driven pumping station of the Salem, Mass., sewerage system. This rate, it may be remarked, is made possible by a steam-driven central station only on the use of power during off-peak hours. At the Chestnut Hill high-service pumping station of the Metropolitan Water Works the actual cost was 0.58 cent per horse-power-hour for the year, or 0.78 cent per kilowatt-hour, coal costing $3.91 per ton. An estimate of 0.6 cent per kilowatt-hour, exclusive of fixed charges, is therefore not unreasonably low, though it depends upon at least a 300-kilowatt plant with cheap fuel.

Mr. Fuller's proposal to use electrolytic chlorine or bleaching powder prepared from chlorine is entirely distinct from the various English processes and the older American Woolf process. These latter make hypochlorites, or oxychlorides as they are often called, in one operation at a great sacrifice in efficiency. The gaseous chlorine can be made at much greater efficiency per pound of available chlorine. It is conservative to figure that electrolytic chlorine can be prepared for two cents per pound. On this basis the cost of chlorine for sterilizing effluents with five parts per million would be eighty-three cents per million gallons. This would of course apply only to those works whose requirements would warrant the installation of the necessary chlorine and power plant, or where cheap power, hydroelectric or steam, is already available. Caustic soda, used in the soap industry to a large extent, is a valuable by-product of the electrolytic process, and as this always finds a ready market its value would to a large extent offset the cost of the electrical production of chlorine. There is little room to doubt that a bright future is at hand for these electrochemical methods of solving vexatious municipal problems. From the central station standpoint the loads represented by such works are in the highest degree desirable.

MAGNETIC FIELDS.

A simple way of determining the magnetic fields set up by a straight wire carrying an electric current is described in a note contributed to *Science* for September 27, by Mr. W. J. Humphreys, who suggests that the conception of the electron be used, and the problem be presented by considering the magnetic field set up by each electron as it moves along the conductor. In this way it is easy, by means of calculus, to compute the intensity of the magnetic field at any point, but he also suggests a simpler way by considering the field of each electron to be compressed into a plane by the fields of the neighboring electrons. Then each section of the conductor exerts a force only in the plane normal to the conductor. Hence all that need be considered to determine the force at a point is the number of electrons passing the section of the conductor lying in the normal plane containing the point, and the distance of the point from the conductor. The result follows immediately. The method is simple and pretty. It is allowable if the user explains clearly the assumption which he has made, that of the flattening out of the magnet fields of each electron.

The method might also be extended to the consideration of other magnetic phenomena. The student is first introduced to the conception of a unit magnetic pole from which the magnetic force radiates uniformly in all directions, and then, without any explanation, he is asked to use this conception of a unit pole when all the lines of force must be considered to pass from it in one direction. By assuming the compressibility of the field due to adjacent unit poles the difficulty would disappear, but in all cases it should be clearly understood by the student that he is using an artifice and that the actual conditions may be somewhat different. The student is apt to forget that he is plotting the effects of the magnetic field and not the field itself; that what he measures may be the result of many forces though the forces themselves may be independently exerted. This tendency to consider the effects rather than the thing itself is illustrated by the so-called rotating field set up by polyphase currents. We know that the magnetic forces set up by such currents may produce rotation and we can get the same result by actual rotation of a magnet. But suppose there be nothing in the field which can rotate, what then is rotating? May not this action be likened to that caused by a number of engine cylinders placed angularly so that they may rotate a shaft? We have outer-phase alternations which produce rotation, but if the shaft be taken away there is nothing to rotate and hence no rotation. If one could not observe the cylinders but is forced to study only the effects they produce upon the shaft, he would naturally think that there must be some rotary effect even though the shaft be not there; in other words, we are apt to confine our thoughts too closely to the effects produced and not to give sufficient consideration to the limitations introduced by the apparatus by means of which we observe these effects. In plotting the magnetic field in the usual way, we are merely plotting the effects of the field on our instruments. The actual strains in the ether may be quite different.

A NEW BLUE-BLACK IRON PAINT AS A PROTECTIVE COVERING.[1]

BY F. J. R. CARULLA.

In the preparation of iron and steel rods for wire drawing and galvanizing, as also in the preparation of plates for tinning, etc., the iron is kept for a time in a bath of acid to remove the scale. The acid used may be sulphuric acid, when a solution of sulphate of iron ("copperas") is produced, or hydrochloric acid may be employed, when a solution of chloride of iron is obtained.

A number of methods have been devised to utilize these solutions, and it is the object of this paper to bring before you the one which appears to be the most valuable when chloride liquors have to be dealt with. The acids named are not absolutely neutralized by the use that they are put to, so that the liquors are still active and have to be "killed" before they are subjected to any operation for the recovery of the iron and of the acid in any form.

The sulphate "waste pickle" liquors, as they are termed, are killed or neutralized by the addition of scrap, producing a neutral solution from which copperas in the solid form is obtained, these liquors being one of the main sources of this material. When hydrochloric acid is employed ferrous chloride is produced, which is not so tractable a salt as the sulphate, owing to its great solubility, and besides, the demand for it is insignificant when compared with that for sulphate.

The chloride liquors are consequently generally dealt with by adding some base, which, combining with the chlorine, will precipitate the iron as an oxide, and that which naturally suggests itself is lime. This has been employed, but the calcium chloride produced being also a very soluble and deliquescent substance with little use for it, the process can only be resorted to as a necessity. Certainly the calcium chloride solution might be run away, but a better use might be to employ it for watering roads and preventing the dust arising from the passage of motor-cars, a use to which this salt is said to have been successfully applied. Potash and soda have also been suggested and employed as bases for the precipitation of the oxide of iron, but the product obtained has obviously a value much below that of the materials employed. To turn caustic soda into common salt can not be a very profitable process, nor yet to use potash and obtain chloride of potassium.

[1] Read before the Iron and Steel Institute, Vienna, September, 1907.

The idea occurred to Dr. C. F. Wülffing, for some time a resident in the Swansea tinplate district, that ammonia might be employed to effect the precipitation in question, seeing that the value of the ammonium chloride is greater than that of the ammonia employed.

The great drawback to such a process naturally is that the volatile nature of ammonia requires special attention to be given to the apparatus employed, which must necessarily be closed, and every possible means of escape of the ammonia prevented. Especially is this the case, as the liquor has to be blown for a considerable period in the presence of ammonia, some of which the air carries off, and provision has to be made in the plant not to lose this ammonia.

The necessity for this blowing or oxidation arises from the fact that Dr. Wülffing's main object is to obtain a black oxide of iron, which is only produced after long exposure to the air blast. This oxide, which is obtained as a beautiful blue-black color, is quite insoluble in water, and when passed into the filter press leaves a clear solution of ammonium chloride, which is evaporated and allowed to crystallize. The blue-black precipitate is magnetic, showing it to be Fe_3O_4, and is a valuable addition to the list of pigments that can be employed with advantage for the protection of structural ironwork.

By similarly treating the chloride liquors with other bases a black color can be obtained, but it is not of the extreme fineness possessed by the substance when ammonia is employed. It is also necessary to consider that absolute chemical purity is unattainable whatever method may be employed. If the process be attempted with lime, some of this, which is a most undesirable impurity, remains behind, the color produced being, besides, of a poor quality. With ammonia, on the other hand, the black oxide is left with a trace of a double salt, which Dr. Wülffing regards as NH_4Cl, $FeCl_2$. This acts beneficially on the paint, although ammonium chloride by itself would not do so. Structures that have been painted with this blue-black oxide of iron (boiled linseed oil being used in the preparation of the paint) have kept fresh though exposed to the weather for nearly two years, still showing a varnish-like surface.

A Jackson, Tenn., man, H. R. Moore, has brought suit for $25,000 against the Cumberland Telephone and Telegraph Company, for alleged failure to put in a telephone after being ordered to do so.

New Plan to Give Chicago Municipal Power.

A new plan to supply electrical current developed at the power plant of the drainage canal at Lockport for use in lighting the streets of Chicago, Ill., has been put forward by City Electrician Carroll. In order to get around the statute which makes it mandatory for the Sanitary District to obtain frontage consents from property owners before erecting poles and stringing wires in the streets, it is proposed that the city shall do this work, meeting the transmission wires of the Sanitary District at the city limits.

During the Dunne administration the case of granting permits to the drainage board to put up transmission wires within the city was put before Col. J. Hamilton Lewis and Assistant Corporation Counsel Barge. The latter held that in the sale of electricity the Sanitary District is acting in its private capacity as a corporation, quite apart from its mission in disposing of sewage, and therefore must be bound by the same rules as other private corporations. When E. J. Brundage became corporation counsel, the matter was referred again to the department. Mr. Barge for a second time went over the laws and was of the same opinion.

"Telephotography"

A correspondent of *Nature*, London, objects to the use of the word "telephotography" to designate telegraphic transmission of pictures as, he says, the word has been adopted to designate photography by means of the telephoto lens of Dallmeyer. To this criticism, Shelford Bidwell makes the following reply:

I believe that the word "telephotography" was coined by myself, and first appeared at the head of an article published in *Nature* on February 10, 1881, in which an account was given of the earliest attempt to transmit photographic pictures by electrical means. The term was at the time generally adopted by the press, and has found its way into several books of reference. In the "Century Dictionary" (1900) telephotography is defined as "the art (not yet attained) of producing a photograph, distant and invisible from the camera, by means of electrical connections with a suitable apparatus near the object." No other meaning is given.

The word was not employed in the sense in which it appears to be now current among photographers until at least ten years later, the date of Mr. Dallmeyer's invention being 1891; but I have no great affection for my neologism, and propose in future to write "telegraphic photography," thus avoiding the possibility of confusion. "Phototelegraphy" I take to mean signaling by flashes of light, as in heliography.

The Telephone Situation in Australia.

The following amusing story has been taken from the London *Electrical Engineer,* of September 27. The subject is not at all new, but in its present form it will no doubt appeal to many readers, particularly the telephone men. The story is headed: "Wanted—a Telephone. How I Got It." By One o' Five.

The following article cut from an Australian paper has been sent us by a friend, and, unfortunately, the name of the newspaper has not been included. It reminds us that when we installed the telephone the first entry in the official directory was useless for two reasons, as both name and address were incorrect. The *Electrical Engineer,* 139-140 Salisbury Court, E. C., was changed into *Electric Engineer,* Salisbury House, E. C. The Australian skit reads:

"Numbers of householders who are desirous of installing a telephone are deterred by ignorance of the departmental regulations and the fear of red tape. The procedure is really so simple that a few notes, forestalling the efforts of the proposed post-office publicity department, may prove of interest to intending subscribers.

"The first step is to write to the deputy P.M.G., stating the position of the premises, and asking particulars of the fees payable. By return post you will receive a printed card (Form XO, 982) stating that your letter has been duly received and is having attention. This card is sent by the office boy, and has no real bearing on the subsequent proceedings.

"After this effort the department takes a brief rest to recover its strength, and then plunges into a series of abstruse calculations over a period of some weeks. The result of this mountain in labor is an absurdly inadequate mouse, in the shape of a circular (Form CB, 67), informing you that your telephone will cost you five pounds per annum for a maximum of 2,000 originating calls. If this startling example of departmental omniscience does not overpower you you may write to the D.P.M.G., accepting his offer, and instructing him to proceed with the work.

"Within ten days, or thereabouts, you will receive another circular (Form C, 1,546), requesting you to sign the attached agreement and pay twelve months' rent in advance. Having done this you may safely take a holiday.

"After an interval of, say, a month, it is as well to write to the D.P.M.G., pointing out that you have only a lease of the premises, and are, therefore, anxious to have the telephone as soon as is convenient. You will receive no reply to this (Form XY, 1,273, being out of print), but a few weeks later a very civil-spoken young man will present a half-gallon 'billy' at your back door, and request a little hot water for breakfast. If you direct attention to the size of the billy the man will point out two of his mates who are sitting on your roof and two others standing in an expectant attitude in your back garden, a sixth man will be found standing at the head of a linesman's handcart out in the right of way. The men on the roof are discussing where they will fix your telephone wire, while the men in the garden are waiting to catch them in case they roll off. This tends to show the perfection of the organization which exists in all great government departments.

"If the weather keeps fine the necessary wires will soon be connected, and nothing then remains but to obtain the telephone instrument. After waiting, say, two or three weeks without result, you should write to the daily papers, directing attention to the facts, and signing yourself 'Disgusted Taxpayer.' On the day following the insertion of your letter the 'official explanation' (Form XO, 73) will appear in a prominent position in the news columns. The explanation will set out that the postal department is not to blame, since it ordered seven telephone instruments in 1904, but the demand has been so great that these have already been used. It will further explain that tenders are being called for ten additional instruments, and arrangements are being made for prompt delivery. Again, it will state that all applications are dealt with strictly in order of priority, and as soon as the 1,196 back orders are completed, 'Disgusted Taxpayer's' application will receive immediate consideration.

"The same day's evening paper will contain an interview with the minister concerned, who will express regret that 'Disgusted Taxpayer' did not write direct to the department under his own name. The minister will add that he is completely reorganizing the department, and, although only nine months in office, he has already had two telegraph poles repainted and a piece of orange peel picked off the steps of the G.P.O. The interview will conclude with a statement that the minister has 'called for a report.' This is a most arduous and dangerous undertaking, which can not be safely attempted by any one drawing less than £2,000 a year, with prospects of £200 increase.

"As the result of the publicity given to your case by the press, a telephone instrument will be sent out to your house, and you must then act with the utmost circumspection if you would avoid disaster. Foolish people with no knowledge of departmental methods are apt to directly address the instrument-fitter, saying: 'I want the telephone placed here in the hall.' This, however, is a fatal mistake. The best way is to suggest, with due diffidence, that the telephone should be placed under the kitchen sink. The fitter will say that is impossible, and express his intention of putting it over the drawing room mantelpiece. At this stage, with a little tact and a violently expressed preference for the sink, you will succeed in having the instrument set up in the hall, where you wanted it.

"Your troubles are now over, and at the modest charge of £5 per annum, in advance, you have a piece of furniture which is an ornament to any house. In the event of your ever desiring to use your new telephone, you should first read the instructions most carefully, and, if you are connected to a suburban exchange, it is always as well to drop a postcard to the manager the day before you ring up. Attention to this little point will insure the prompt attendance of an operator when you do ring, and you will then learn without unnecessary loss of time that the number you want is engaged.

"Three months, or thereabouts, after the telephone is installed your name (incorrectly spelled and with some one else's initials) will be duly inserted in the official 'Telephone Directory,' and earth will hold no further joys in store.

"It will be seen from this that installing a telephone is a perfectly simple operation, and, if due regard is paid to the hints here given, the whole thing can be fixed up within the year."

American Electrochemical Society.

In addition to the programme which was announced in the ELECTRICAL REVIEW of last week, the following papers will be presented at the session on the morning of Saturday, October 19: "On the Treatment of Storage Battery Elements before Putting Them out of Commission," by Professor O. W. Brown; and "A Further Study of Concentration Cells," by Dr. Henry S. Carhart.

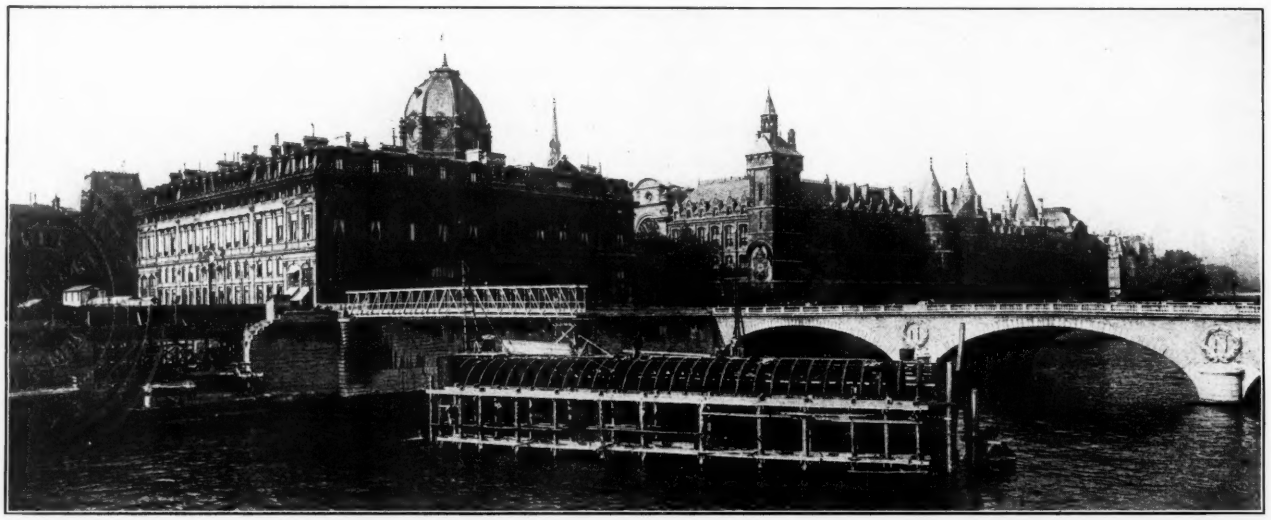
It is also announced that an excursion has been arranged to the large electrolytic copper refinery at Chrome, N. J.

The Subway Work of the Paris Metropolitan.

By C. L. Durand.

UPON the new section of the Paris (France) subway there is being carried out a most interesting piece of construction work which consists in the sinking of metallic caissons of large size in order to afford the proper facilities for the passage of the line. Section No. 4 of the Metropolitan subway follows a north and south direction across the city at a right angle to the first section of the subway which follows the general direction along the Seine. This north-south line extends from the Clegnancourt gate to the Orleans gate, reaching the city limits at each end of its course. It is to be built in general of the standard construction which is now adopted for the rest of the subway sections; this being a cement-lined tunnel of a more or less elliptical section containing the two tracks of the electric third-rail road lying side by side. The underground stations are also of elliptical section, but are naturally much larger and contain a station platform on each side for one of the tracks.

The present No. 4 section of the subway differs from the usual standard type at the point where it crosses the Seine in the special method which had to be adopted owing to the fact that it passes in water-soaked ground and thus it could not be built in the same way as the other portions of the subway. It is to be noticed that according to the present system of Metropolitan lines, which cover the city, the already-built or the projected lines cross the Seine as many as five times, but in this case upon bridges which were specially constructed for the purpose. Thus the line known as No. 2 south circular line crosses the Seine upon a new iron bridge at Passy, and the same is the case with line No. 6 which crosses the river at Bercy and serves to connect the previous section with the line on the north bank. At Austerlitz, section No. 5 crosses the Seine on an iron bridge. Line No. 8 will cross upon a special bridge at Auteuil and also at Place

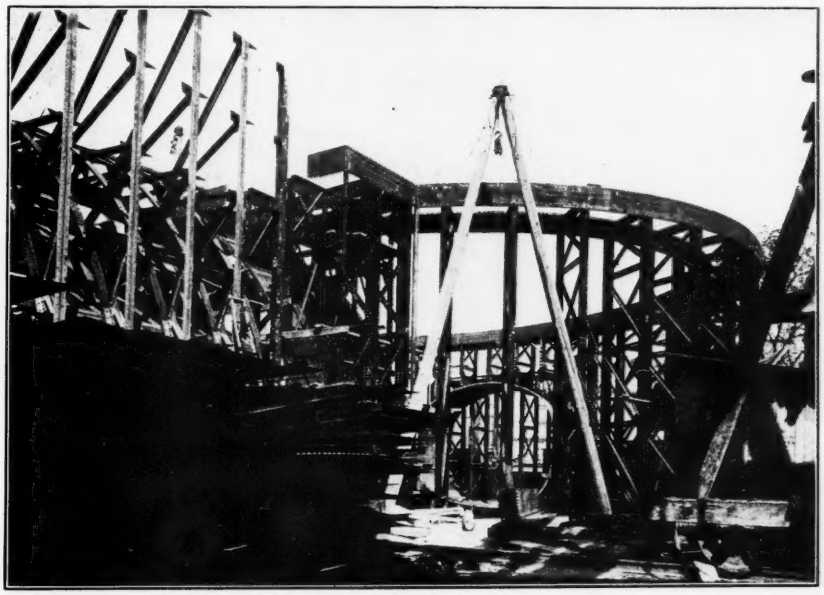


PREPARING TO SINK A CAISSON IN THE SEINE FOR THE PARIS METROPOLITAN.

ELLIPTICAL CAISSON AND PART OF MIDDLE SECTION FOR UNDERGROUND STATION, PARIS METROPOLITAN.

de la Concorde. But in all these cases the conditions are different. In many circumstances iron bridge construction can be used wherever the local conditions make it possible, these having relation to the street traffic and also aesthetic considerations. In some parts of town a considerable length of the road is taken upon an elevated viaduct of ironwork, but these cases are in the outlying districts where there are wide boulevards upon which the traffic is relatively small, and there is therefore no disadvantage from the use of viaducts. The same is true in the case of the bridges above mentioned, seeing that their approaches do not lie upon streets in the central part of the city.

The case is different, however, for line No. 4, as it crosses the Seine from the Chatelet Place, on one side, passing across the City Island and reaching St. Michael Place, running through the central part of the city. Both on account of the heavy street traffic over this portion of the city and also for aesthetic reasons, the use of iron bridges across the Seine was impracticable, and it was decided to run the Metropolitan line entirely in tunnel at this point. This made it necessary to carry out an important construction so as to pass underneath the Seine, and the expense is, of course, very much greater than with a viaduct system. Such a construction involves many engineering difficulties, and this led the Prefect of the Seine to apply for a certain number of competitive projects from leading engineering firms. The original idea was to have two separate tunnels excavated below the Seine by the compressed-air shield system, the tunnels to be of circular section, one for each track. They were to cross both arms of the Seine and the City Island lying between them, and then connect with the single tunnel of standard section at each bank. Such tunnels were to measure 16.5 feet inside diameter. One of the leading Paris constructors, the Chagniaud firm, proposed a solution which appeared to solve the problem in a better way, for different reasons. Here a single tunnel will pass under the river and it can thus be made of standard section so as to be directly connected with the shore ends, keeping a double track in all cases. The tunnel is formed by sinking a number of caissons in the bed of the river to the required depth. Its upper surface can thus be brought nearer the bottom of the river than in the case of a tunnel driven by shield, and this has a great advantage in raising the level of the rails so as to lessen the grades between this part of the line and the shore sections. Instead of keeping the rail level at 46.3 feet below the surface of the Seine, it can now be brought up to 36.6 feet, with a consequent diminution of the gradients, and these will not exceed four per cent, even in exceptional cases, while for the most part the grades will be much lower.



END OF ELLIPTICAL CAISSON AND PART OF MIDDLE SECTION FOR UNDERGROUND STATION, PARIS METROPOLITAN.

In the work which is carried out under the Seine and on the shore sections of the tunnel there are three distinct methods of construction used. For the shore sections running to a certain distance from the banks, the tunnel will be built by the use of a special shield, working with compressed air. For the portion lying in the river bed, compressed-air caissons are sunk directly from the bottom of the river down to the required level. Besides, there are two large underground stations which lie upon this portion of the line, one of these being located in the City Island and the second on the south bank at St. Michael Place. Both of these stations will consist of an assemblage of immense caissons which are sunk below the ground level. A third method of working is to be used later on, when it comes to joining the St. Michael shore station with the river-bed tunnel. The work will be carried on at a point lying underneath the Orleans Railway, which also passes under the Seine quays. To prevent any possible sinking of the latter road, the process of freezing the ground is to be employed, which is a somewhat novel one.

One of the engravings shows the general appearance of one of the compressed-air caissons which cross the large arm of the Seine. There are three sections of caissons which make up the tunnel under the large arm of the river, while the short arm requires but two of these. The caissons are formed of two essential parts, the inner part, or tunnel proper, and an outer framework. The inner tunnel is built up in a form approaching an ellipse, similar to the standard double-track tunnel section. It is composed of iron rings having this section. Each of the rings is made up of a series of voussoirs of cast iron which are of the properly curved shape so as to form the elliptical ring. The voussoirs are bolted together as in bridge construction for each of the rings; when one ring is complete it is bolted to the preceding one, and in this way is made up a continuous iron tube. Between the rings are placed pieces of treated wood so as to form watertight joints.

Around the main tube there is built a metallic shell which serves as the caisson, in order to sink the tube under the water. The skeleton frame of the shell is formed of a series of curved ribs of channel bar which lie outside of the tunnel tube and are braced at a certain distance and nearly parallel to it, by means of cross-braced ironwork. However, the ribs are not brought around under the tube, but are run down vertically from the centre so as to form straight sides for the caisson. The ribs run somewhat below the bottom of the tunnel, and underneath the latter is formed a compressed-air chamber in which the workmen proceed with the lowering of the caisson. Over the ribs is placed a

sheet-iron covering which is thus brought down to the bottom level forming a rectangular box portion.

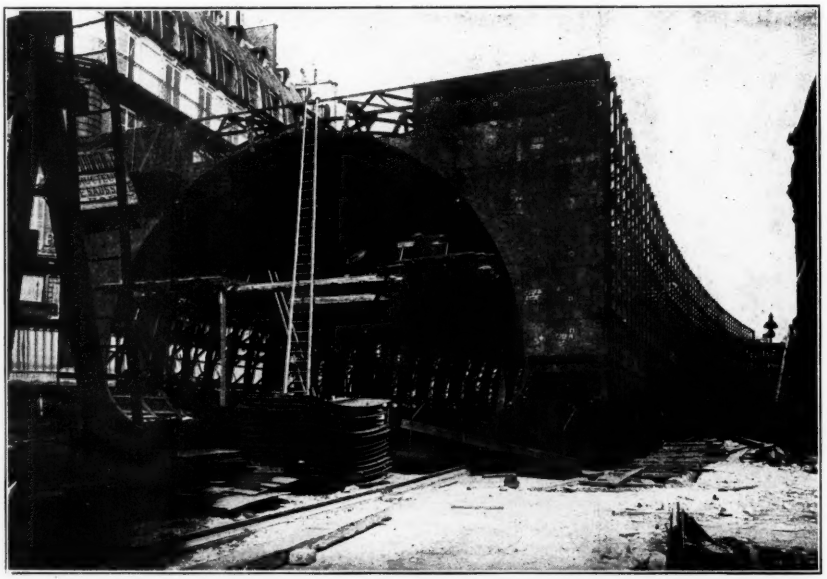
After towing the caisson in place, the space between the tunnel tube and the sheet-iron sides is filled up with cement beton, the top plating having been left off for this purpose. After completing the iron plating of the caisson, it is sunk upon the bed of the river, this portion having been properly prepared beforehand.

Piles were driven in the river bed so as to guide the caisson on its descent and to shield it. The piles also support a platform for the workmen, who have access to the lower part of the caisson by means of tubes which descend from the surface, with air-locks mounted at the top. As the ground is excavated the caisson is gradually lowered down to the proper level under the river bed, the tunnel tube having been ballasted with water so as to give the needed weight and to steady the whole. When in place, the lower chamber of the caisson is filled up with beton, the shafts removed and the water pumped out of the tunnel tube.

The ends of the caissons lie about five feet apart, and the interval is filled by a small caisson which is sunk afterwards in place. By removing the sheet-iron end plating of all the caissons, a continuous tunnel of the standard section is formed.

The two underground stations which are situated upon this portion of the line are of unusual interest, owing to the method which has been adopted for their construction. One of these stations lies on the City Island and therefore between the two river-bed sections just described. The second station, which is the larger of the two, is placed at the south end of the Seine tunnel at St. Michael Place, and is connected to this end of the tunnel. The description herewith applies especially to the latter station, as it is the larger and more important of the two. Both of them, however, have the same method of construction.

We have already mentioned that the portions of the tunnel lying near the river are to be run by a special compressed-air shield, as the ground is watersoaked for some distance from the river, at least at a certain depth below the surface. But as the stations are of a much larger size, it would be out of the question to adopt a shield system for constructing them. It was therefore necessary to use the caisson method for the stations as well as for the preceding work. For each of the stations three separate caissons are employed, but these are much different from those which lie in the river bed. Essentially, each station consists of a long portion of more or less elliptical section, terminated by two other portions of cylindrical form, one at each end. Referring to the St. Michael station, there is a central caisson which is



Middle Caisson for Underground Station, Paris Metropolitan.

noteworthy for its great size, seeing that it is about 220 feet long and sixty feet high over all. The central part or tunnel, is forty-one feet wide and about twenty-eight feet in height. As will be observed in the engravings, the section of the interior part is formed of a semi-circular part in the upper portion, while the bottom part or bed is of elliptical form.

This construction is used in the main part of the station, and will contain the two station platforms for passengers, lying on each side of the double track. Joined to each end of the caisson is a smaller one which is built in a different manner, seeing that it has the form of an elliptical well whose bottom lies about seventy-five feet below the surface, with the larger axis measuring eighty-five feet and the smaller, sixty-one feet. It is to be used to contain the staircases, elevators and ticket offices and to the outer ends will be connected the other sections of the subway. On the end next the river it will join on to a short section which leads to

Inside of Middle Caisson for Underground Station, Paris Metropolitan.

the caisson tunnel above described, while the corresponding part on the other side will connect with the subway tunnel which is to be built hereafter.

The general appearance of the middle caisson will be seen from the engravings. One of these shows the outside of the metallic framework, and the second the interior of the structure. The under part of the construction, lying below the tunnel proper, is in the form of a long compartment six feet in height in which the workmen are placed, this part being operated under compressed air for sinking the caisson. As to the inner metallic framework of the main structure, it is formed of a series of trusses having the standard section and spaced four feet apart. The trusses are connected by an iron-work bracing. A sheet-iron plating is mounted inside upon the structure, so as to form a continuous tube. Around the tunnel portion is mounted an outer shell of ironwork which constitutes the exterior of the caisson. The outer part is, however, of rectangular section, and it is faced on the outside and at the ends with sheet-iron. Between the outer plating and the tubular part is flowed concrete so as to fill up the entire space, and this gives a great solidity to the whole. The thickness of concrete is about six feet at the sides and three feet at the top of the arch.

To give the proper lining to the station part, the sheet-iron plating is covered by a fine concrete upon which is fixed a lining of enameled tile such as is used in the other subway stations. The concrete is held upon a metallic trelliswork which is fixed upon the sheet-iron. As the construction has a very great weight, this being no less than 18,000 tons, counting 11,000 tons for the ironwork and 7,000 tons for the concrete, great care must be taken in sinking it below the surface so that there will be no accidents. The caissons have been built in a trench eighteen feet deep, and they are then sunk without the use of compressed air until the wet ground is reached, after which the work is continued by compressed air until the caisson rests upon a bed of solid rock at a depth of seventy-five feet below the surface. To this end the under air-chamber of the caisson is divided into two independent parts by a cross partition. Each of the chambers thus formed is provided with four working shafts. In this way a better division of the work will be obtained.

At either end of the central caisson is an elliptical caisson. Both are practically alike, and consist of an iron-work structure presenting its small axis in the line of the tunnel. The structure is given a thickness of six feet, and upon the inside and outside is a plating of sheet-iron. Concrete is filled in between the two linings. When sunk in the ground, the whole has the form of an immense elliptical well. Upon the top of the structure is placed a series of beams which receive a layer of masonry. This layer will be brought up to within three feet of the ground level. On the outer side is a junction mouth of the standard tunnel section, so as to receive the main tunnel which joins at this point. For each of the end caissons there are 650 (long) tons of iron and 2,500 tons of beton. Counting the weight of the whole structure, it is no less than 25,000 tons. Its total length is nearly 400 feet.

On the Corpuscular Rays Produced in Different Metals by Roentgen Rays.

It has been shown by Sagnac and others that when Roentgen rays fall on a substance this substance gives off rays very like the Roentgen rays producing them. Barkla has investigated these rays and found that those from gases and light solids are almost identical in penetrating power with the primary rays producing them, while those from heavy solids, such as lead and zinc, are much less penetrating than the primary. He also finds that the rays from gases and light solids vary in penetrating power as the primary varies, but those from the heavy solids vary very little for much variation in the penetrating power of the primary. All these secondary rays are probably pulses in the ether, like Roentgen pulses, though the secondary pulses vary greatly in thickness from the primary producing them, heavy metals giving out much thicker pulses than the primary. Besides this type of rays, it has been shown that heavy metals, when Roentgen rays fall upon them give out a very absorbable power of radiation consisting in part of negatively charged particles. The velocity of these particles is of the order of that of the cathode particles in a highly exhausted tube. In this article C. D. Cooksey gives the results of an investigation with a view to determining the relative number of these absorbing rays, which are known as corpuscular secondary rays, produced in different metals for equal absorption by the same beam of Roentgen rays. In the investigation it was necessary to differentiate between the effects due to the secondary radiation and those due to the primary, and as the former are small in comparison with the latter, direct measurement of the primary effect alone and of the primary plus the secondary was not satisfactory. The method adopted consisted in exposing different samples of metals to the Roentgen rays, and arranging the electrometer so that the deflection produced by the direct ray was just balanced; then any motion of the gold-leaf would be due to the secondary radiation being steady. In this way the effect of the primary and secondary radiation could be separated, but it was necessary also to separate the effects the different kinds of secondary radiation in order to measure the corpuscular secondary rays. This was accomplished by covering the metal so experimented with by thin aluminum foil, the foil being added in successive layers. In this way a curve was secured, falling off rapidly at first, and then gradually. The rapid falling off is assumed to be due to the absorption of the corpuscular rays, since these have little penetrating power, and in this way the author was enabled to measure their intensity. From his experiments he concludes that the velocities found from the absorption in aluminum of the corpuscular secondary rays from heavy metals are in good agreement with the values found by other investigators; that the more penetrating primary rays produce more penetrating corpuscular secondary rays. For the more penetrating primary rays used, the corpuscular rays from all the metals tested, with the exception of nickel, possessed nearly equal penetrating power, while for the less penetrating primary rays, the penetration of the corpuscular rays varied considerably for the different metals. The corpuscular rays produced by hard primary rays are homogeneous. Those produced by soft primary rays are not homogeneous except for tin and silver. In all the other metals tested, with one exception, silver, the ratio of the number of corpuscles produced to the number produced in lead was greater for metals of greater density. The ratio of the number of corpuscles liberated from a metal to the number liberated from lead depends partly on the penetrating power of the corpuscular rays, and to a great extent on the ratio of the absorption or efficiency of the primary rays in lead and the metal compared with it. If the energy of the corpuscular ray is due, as J. J. Thomson has suggested, to an explosion of the atom, and not directly to the energy in the primary pulse, it is hard to explain why the more penetrating primary rays give rise to corpuscles of higher velocity than do the softer rays, while the intensity of the primary rays makes no difference in their velocity.—*American Journal of Science (New Haven), October.*

Street Railway Week at Atlantic City.

Annual Conventions of the American Street and Interurban Railway Association, the Engineering Association, the Claim Agents' Association and the Accountants' Association; Appliance Exhibition of the Manufacturers' Association.

THE annual conventions of the American Street and Interurban Railway Association and its affiliated and allied associations, the Engineering, Claim Agents' and Accountants', will be held at Atlantic City, N. J., October 14-18. The meeting of the American association will be held in Casino Hall, located at the board-walk end of the steel pier; the meetings of the Accountants' association will be held in the Chalfonte Hotel; the meeting of the Claim Agents' association will be held in the St. Charles Hotel, and the meetings of the Engineering association will be held in the sun parlor near the outer end of the steel pier.

The morning of Monday, October 14, will be reserved for registration purposes. The first meeting of the convention will be held on the afternoon of that day.

On Tuesday morning there will be meetings of the Accountants', Engineering and Claim Agents' associations. On Tuesday afternoon these same associations will hold meetings.

On Wednesday morning there will be a joint meeting of the American and affiliated associations. On Wednesday afternoon the Accountants' and Claim Agents' associations will meet.

On Thursday morning the American association and the Accountants' association will meet, and on Friday the American association will finish up its work.

The following programmes have been announced for the American association and the Engineering association:

AMERICAN STREET AND INTERURBAN RAILWAY ENGINEERING ASSOCIATION.

MONDAY, OCTOBER 14—9.30 A. M. TO 12.30 P. M.

Registration at steel pier.

2 P. M. TO 5 P. M.

Convention called to order.

Address—John I. Beggs, president, American Street and Interurban Railway Association.

Reading of the minutes of the last meeting.

Address of the president.

Annual report of the executive committee.

TUESDAY, OCTOBER 15—9.30 A. M. TO 12.30 P. M.

Report of "Committee on Way Matters."

Paper—"Care of Electric Railway Tracks," by George L. Wilson, engineer, Twin City Rapid Transit Company, Minneapolis, Minn.

Paper—"Rails and Joints as Affected by Traffic in New York city," by W. Boardman Reed, engineer, New York city.

TUESDAY, OCTOBER 15, 2 P. M. TO 5 P. M.

Report of "Committee on Standardization."

Report of "Committee on Open *versus* Closed Terminals for Car Storage."

WEDNESDAY, OCTOBER 16—9.30 A. M. TO 1 P. M.

Joint meeting of "American" association and allied associations.

2.30 P. M. TO 5.30 P. M.

Paper—"Gas Engines," by Paul Winsor, chief engineer motive power and rolling stock, Boston Elevated Railway Company, Boston, Mass.

Paper—"Gas Engine Operation," by W. W. Cole, general manager, Elmira Water, Light and Railway Company, Elmira, N. Y.

Paper—"Steam Turbines," by St. John Chilton, engineer, Allis-Chalmers Company, Milwaukee, Wis.

Annual report of secretary-treasurer.

Appointment of convention committees.

Reports of special committees.

Report of "Committee on Control Apparatus."

Report of "Committee on Maintenance and Inspection of Electrical Equipment."

Report of "Way Committee" on "Rail Corrugation Investigation."

Report of "Way Committee" on "Concrete Tie Investigation."

Report of sub-committee on "Rail and Rail Matters."

Report of committee on "Operating and Storage Car House Designs."

Question Box.

Paper—"Operating Features of Curtis Turbines," by August H. Kreusi, engineer, General Electric Company, Schenectady, N. Y.

Paper—"Recent Developments in Steam Turbine Power Station Work," by J. R. Bibbins, engineer, Westinghouse Machine Company, East Pittsburg, Pa.

General business.

Election of officers.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION.

WEDNESDAY, OCTOBER 16—9.30 A. M. TO 1 P. M.

Convention called to order.

Address of welcome.

President's address.

Report of executive committee.

Report of secretary and treasurer.

Addresses by presidents of affiliated and allied associations.

Announcements.

New business.

Reports of committees.

(*a*) Membership.

(*b*) Compensation for Carrying Mail.

(*c*) Subjects.

(*d*) Car Wiring.

(*e*) Standardization of Equipment.

THURSDAY, OCTOBER 17—9.30 A. M. TO 1 P. M.

Appointment of nominating committee.

Reports of committees.

(*a*) Promotion of Traffic.

(*b*) Rules.

(*c*) Heavy Electric Traction.

Paper—"Light Freight Handling by Electric Lines," by P. P. Crafts, general manager, Iowa & Illinois Railway Company, Clinton, Iowa.

Paper—"Freight Interchange with Steam Railroads," by H. H. Polk, president, Interurban Railway Company, Des Moines, Iowa.

Paper—"A Department of Publicity," by J. Harvey White, advertising manager, Boston Elevated Railway Company, Boston, Mass.

FRIDAY, OCTOBER 18—9.30 A. M. TO 1 P. M.

Reports of committees.

(*a*) Insurance.

(*b*) Rules for the Construction of Modern Car Houses.

(*c*) Municipal Ownership.

(*d*) Public Relations.

Paper—"Public Policies of the Past and Future," by C. Loomis Allen, vice-president, Utica & Mohawk Valley Railway Company, Utica, N. Y.

Paper—"Interurban Railway Fares," by Theodore Stebbins, J. G. White & Company, New York, N. Y.

Paper—"The Technically Trained Man and the Electric Railway Profession," by

Professor H. H. Norris, Cornell University, Ithaca, N. Y.

Paper—"The National Fire Protection Association and Its Work in the Street and Interurban Railway Field," by Ralph Sweetland, Boston, Mass.

Paper—"The Influence of the Design of Railway Structures on Economy of Operation," by H. J. Campion and William McClellan, consulting engineers, New York, N. Y.

Paper—"Advertising from the Street Railway Standpoint," by A. W. Warnock, general passenger agent, Twin City Rapid Transit Company, Minneapolis, Minn.

Paper—"The Problems of a Small Road," by H. S. Cooper, manager, Galveston Electric Company, Galveston, Tex.

Paper—"The Use of Tee Rail in Cities," by C. Gordon Reel, vice-president, Kingston Consolidated Railway Company, Kingston, N. Y.

Paper—"Municipal Ownership in Great Britain and in the United States," by Wm. J. Clark, New York city.

Discussion—"Reduced Fare Agitation."

Discussion—"Depreciation from the Financial and Managerial Standpoints."

Report of nominating committee.

Election of officers.

Resolutions.

Unfinished business.

Adjournment.

Each of the various associations has decided to have its own headquarters as follows: American association and Manufacturers' association Marlborough-Blenheim Hotel; Accountants' association, Chalfonte Hotel; Engineering association, Dennis Hotel; Claim Agents' association, St. Charles Hotel.

Through the courtesy of the Delaware & Atlantic Telephone Company, the Bell Telephone Company of Philadelphia, and the American Telephone and Telegraph Company, free local exchange service day and night will be extended from all stations on the steel pier. Free toll line and long-distance service will be extended before 9 A. M. and after 6 P. M. to delegates and guests upon presentation of the various official badges.

On Monday evening, October 14, the entertainment committee has arranged for an hour with Miss Kitty Cheatham in the solarium of the Marlborough-Blenheim Hotel.

On Tuesday afternoon, October 15, a roller-chair parade for the ladies will begin at 2.30. On Tuesday evening, at 9 o'clock, the annual reception in honor of the presidents and other officers of the associations will be held.

On Wednesday afternoon, from 2.30 to 5 o'clock, there will be a ladies' afternoon at the Country Club of Atlantic City. The ladies are invited to bring their golf sticks and tennis rackets. There will be music and afternoon tea, and prizes will be awarded for the ladies' clock golf contest. On Wednesday evening there will be a theatre party at Young's Pier Theatre and the Savoy Theatre.

On Thursday afternoon there will be a trolley trip for the ladies of the convention to Ocean City, *via* the Shore Fast Line. Special cars will leave the board-walk and Virginia avenue at 2.30 P. M. sharp, returning at 5.30 P. M. On Thursday evening the third annual Supply Men's amateur vaudeville and theatrical performance will be given at Young's Pier Theatre at 8.30 o'clock. There will be informal dancing from 11 to 12.30 P. M. in the ballroom of the Marlborough-Blenheim Hotel.

On Friday afternoon, October 18, there will be a men's golf tournament at the Country Club of Atlantic City. On Friday evening there will be an entertainment at the Marlborough-Blenheim Hotel, followed by informal dancing.

The appliance exhibition under the auspices of the American Street and Interurban Railway Manufacturers' Association will be held on the entire Atlantic City steel pier. The rolling stock and track exhibits will be on Virginia avenue, directly off the board-walk and opposite to the entrance to the steel pier. The exhibit will be the most extensive that has ever been held by the association, and the following features will be prominently displayed:

The Allis-Chalmers Company's space (201-211) occupies approximately 1,400 square feet, and will contain a very extensive exhibit of air-brake apparatus, together with photographs and other representations of steam turbines, Corliss engines, gas engines, hydraulic turbines, condensers, generators, rotary converters, motors and power and electrical machinery of every kind, such as constitute the complete equipment of traction companies for power-houses, substations, cars, etc.

One of the most interesting features of this exhibit will be found in the new type "J" emergency valve for use with straight air-brake equipments. The principal advantage of the straight air-brake system, as is well known, lies in its simplicity and in the fact that the brakes may be applied and released gradually; but it formerly had one serious defect, for, when two or more cars are run in a single train having this equipment, if the train should break apart the brakes would not be applied automatically. Moreover, in the ordinary straight air system the control of the train is in the hands of the motorman, alone; whereas with the automatic system the brakes can be applied by the conductor in case of emergency from any one of the cars in the train.

Another object of especial interest will be the new type of pneumatic governor.

Prior to the placing of a very large order for this type of brake it was given an exhaustive test by the engineering department of the Manhattan Elevated Railway, New York city, in a series of 284,000 continuous operations, breaking a current of thirty-five to forty amperes, at 600 volts, without any attention whatever during the period of the test, which would be equivalent to about two and one-half years' service under ordinary conditions.

The exhibit will be in charge of W. S. Heger, assistant to the president, and J. H. Denton, manager of the company's air-brake department. Others in attendance will be various district managers of the company and as many of the salesmen of the several offices, particularly from the East, as can be spared from their regular duty.

The American Brake Shoe and Foundry Company will occupy spaces 410 to 416 on the steel pier. The following representatives will be in attendance: Otis H. Cutler, president; W. S. McGowan, eastern sales manager; Frank L. Gordon, western sales manager; F. W. Sargent, chief engineer; J. S. Thompson, E. L. Janes, E. B. Smith, E. J. Searles. The company will exhibit its steel-back brake shoes and the proposed standards for the Street Railway Association.

The American Railway Supply Company will have an exhibit of badges for conductors, motormen, etc., in space 917, and Charles Lounsbury will be in attendance.

The American Steel and Wire Company will be represented by C. D. Sturdevant, electrical expert, of Worcester, and George Long, expert from the Chicago office. The company is exhibiting in connection with the Carnegie Steel Company, National Tube Company, and other constituent companies of the United States Steel Corporation. This company's exhibit will consist of rail bonds in all varieties, electrical and trolley wires, right-of-way fence for electric railways, concrete reinforcement for construction of power-houses, embankments and bridges. Rail bonds will be installed along the right-of-way tracks which the Carnegie Steel Com-

pany will put down, and these tracks will be fenced in with the company's right-of-way fencing.

Albert & J. M. Anderson Manufacturing Company will make its usual demonstration of electric railway, light and power specialties and will be represented by Ernst Woltmann, William W. Hincher and J. M. Anderson.

The Blake Signal and Manufacturing Company will be represented by E. J. Burke, C. C. Blake and George S. Hastings, and will have a complete working exhibit of standard signal apparatus, together with a trained and competent train dispatcher, and various types of railway telephones and standard blanks, etc., for telephone train dispatching.

The Brady Brass Company will be represented by D. M. Brady and Mr. H. S. Hayward, Jr.

Harold P. Brown will exhibit in spaces 111, 113, 111A and 113A, fronting on two aisles near the shore end of the pier, showing various types of rail joints bonded with standard plastic bonds, plastic plug bonds and semi-plastic plug bonds, showing them under test with a current of 3,000 amperes. He will also show a special electric drill and magnetic clamp for use in rebonding rails without removing angle plates or disturbing the pavement. He will also show the efficiency of his contact alloys on switches, bus-bars, trolley wheels, controllers, contactors, etc. Besides Mr. Brown, James Hollowood, G. A. Kroener, J. Maxwell Coote, Daniel A. Kelley, William Temple and John Roche, will be in attendance.

The Buckeye Engine Company will exhibit photographs of engines and a small model. As usual the company will distribute flowers as souvenirs. C. H. Weeks, vice-president, Salem, Ohio; Paul Bigelow, New York city; James T. Castle, Pittsburg; A. H. Riddell and C. E. Machold, Philadelphia, will be in attendance.

The Chicago Pneumatic Tool Company will exhibit its line of electric tools, together with pneumatic hammers and drills. The 550-volt electric tools will be shown in operation, particularly the track drills and grinders for rail bonding. A specially constructed 550-volt drill for driving screw spikes in railway ties will also be shown. This drill is operated in conjunction with a magnetic switch which controls the action of the drill. This drill will drive the spikes in a very small fraction of the time required by the old method, and is very convenient to handle. The company will show electric hoists, grinders and drills for the lower voltages, and a pneumatic cleaning truck for pneumatically cleaning and scrubbing railway cars. This will be operated by an electric motor. The company will be represented by W. O. Duntley, Thos. Aldcorn, Geo. Barden, C. B. Coates, Howard Small and B. H. Tripp.

The Crocker-Wheeler Company, manufacturers of electric generators, motors, etc., both direct and alternating current, of Ampere, N. J., occupies double exhibit space, having taken sections 464 and 466. The company supplies for street railway service a direct current generator which has become standard for this work and is exhibiting a number of large photographs of installations in this line. The Crocker-Wheeler Company specializes on the generating end of the street railway system and has made a special study of the requirements for this severe service. The company will be represented by Julian Roe, manager of Chicago office, S. Russell, Jr., manager of Philadelphia office, R. N. C. Barnes, manager of Boston office; L. S. Horner, manager of New Haven office; R. J. Randolph, Jr. and Rodman Gilder, of Ampere.

The Crouse-Hinds Company will be represented by H. B. Crouse, A. F. Hills, F. M. Hawkins, Frank Buchanan, Daniel Gidley and Edward Mack. This exhibit will consist mainly of arc headlights, incandescent headlights, guy anchors and conduits.

The Dearborn Drug and Chemical Works will be represented by Robert F. Carr, first vice-president and general manager; W. B. McVicker, second vice-president and eastern manager; Grant W. Spear, third vice-president; G. F. Duemler, manager Philadelphia branch; H. G. McConnaughy, manager New Jersey branch. The company will have ample space so as to arrange a reception booth, and will display its products in a handsome specially designed show-case. The company will distribute its usual souvenirs for the ladies—fine perfumes of its own make, and other suitable souvenirs and general advertising.

The Joseph Dixon Crucible Company will exhibit a portable structural steel building painted with Dixon's Silica-Graphite paint, and exhibits of Dixon's American graphite pencils, greases, Ticonderoga flake graphite lubricants, motor brushes, plumbago crucibles, silica-graphite paint and other graphite products for street railways and manufacturers. The company will be represented by J. A. Condit, L. H. Snyder, C. H. Spotts and J. J. Tucker.

Dossert & Company, incorporated, will make an elaborate exhibit of solderless connectors and terminals, which have been approved and listed by the National Board of Fire Underwriters. H. B. Logan, president, and E. A. Dossert, sales manager, will be in attendance.

The Electric Service Supplies Company will occupy the western half of the acquarium on the steel pier, together with twenty feet outside. This space includes about 1,400 square feet. The company will also have in the music hall an exhibit of Victor high-tension insulators manufactured by the Locke Insulator Manufacturing Company, of Victor, N. Y., being sales agents in the East. The exhibit will also include a full line of protected rail bonds for all styles of rails, and samples of tools for compressing the bonds in the rails, and samples of special hydraulic punches for punching the holes. There will also be a demonstration of the company's improved system of hydraulic rail bonding, which is done on the base of the rail. A complete line of Garton-Daniels lightning arresters for both alternating-current and direct-current circuits and for all voltages up to 20,000 alternating current. A complete line of Keystone overhead material and fittings, railroad crossings, drawbridge pans, etc., and the National railroad trolley guard installed as in service will be shown. Other specialties which will be exhibited are Lyon sheet-steel gear-cases, automotoneers, sheet-steel tool boxes, Keystone railway telephone brackets, commutators, field and armature coils, International cash registers, arc and incandescent headlights, etc.

The Electric Storage Battery Company will show one element of type 71-R in a containing tank sufficiently large to hold eighty-three plates of this type, the tank showing the standard method of reinforcement used on cells at the end of rows. A twelve-pole carbon regulator, recording hydrometer, recording and signaling hydrometer, automatic cell filler and compensating hydrometer will be shown with examples of positive and negative plates of the different types. Charles Blizard, third vice-president; Albert Taylor, manager, New York office; G. H. Atkin, manager Chicago office; E. L. Reynolds, manager, Pennsylvania sales office; H. B. Gay, manager, Cleveland office, and Robert C. Hull, district engineer, will be in attendance.

The Franklin Electric Manufacturing Company will make an elaborate exhibit in conjunction with the Holophane Company. A special feature of the exhibit will be two vibrating machines showing

the conditions under which railway lamps are operated. The "Novi" lamp will be demonstrated as designed and constructed to meet the demand for an incandescent lamp that will withstand more than the ordinary amount of hard usage. The new Franklin Holophane reflectors, both concentrating and distributing, will also be demonstrated in two testing rooms specially constructed for the purpose. The Franklin company will be represented by P. S. Klees, assistant manager; G. O. Curtis, manager of Buffalo office; C. N. Thorpe, manager of Chicago office; and C. Leonard, manager of Baltimore office.

The General Electric Company will be represented by its usual host of good fellows, and will exhibit a complete line of motive and control equipment for street railways and power stations. Large-capacity circuit-breakers, in combination with motor-operated main switches, air-compressors, mercury-arc rectifiers, high-efficiency incandescent lamps and arc lamps, will be shown.

The Goldschmidt Thermit Company's exhibit will consist of two parts: first, an exhibit in the music hall, spaces 664 to 666, at which it will show specimens of the work which it does, such as motor cases and other steel sections repaired by its process, Thermit welded rail joints, samples of ferro-vanadium, metallic manganese, chromium, molybdenum, and other metals which it produces free from carbon by the Alumino-thermic process. At the other exhibit, or rather demonstration space, actual demonstrations will be given of rail welding, preparing motor cases, etc., in order that the delegates may see the process in operation, and become familiar with the Thermit reaction. The company will be represented by G. E. Pellissier, C F. Gailor, H. S. Mann and W. R. Hulbert.

The Gould Storage Battery Company will be represented by Dr. W. E. Winship, sales engineer; H. N. Powers, manager telephone department, and Charles H. Bradley. The company will make its usual exhibit of storage battery parts and photographs showing typical installations.

The Helios Manufacturing Company will have quite an extensive exhibit in connection with the Electric Service Supplies Company, of Philadelphia, of its various types of enclosed and flaming arc lamps, many of which will be in operation.

The H. W. Johns-Manville Company will be well represented with an attractive exhibit and a large number of attendants. Among the materials exhibited will be the "Victor" combination meters, both portable and switchboard types; overhead line material; "Noark" fuse devices, 250, 600 and 10,000-volt capacity; "Transite" asbestos fireproof lumber; molded mica weatherproof sockets; arc-lamp hangers; high-tension insulators; rail bonds; "J-M" friction tape; controller linings; pipe covering, roofing and packing. The company will be represented by J. W. Perry, manager electrical department, New York; H. M. Voorhis, manager electrical department, Philadelphia; H. M. Frantz, manager electrical department, Chicago; R. R. Braggins, manager electrical department, Cleveland; M. H. Crosswell, manager electrical department, Milwaukee; S. P. Russell, manager electrical department, New Orleans; D. T. Dickson, manager Philadelphia branch; E. D. Sparks, sales manager, Philadelphia branch; S. G. Meek, salesman; H. S. Corey, salesman; E. F. Quirke, southern representative; W. F. Little, electrical engineer, New York office; E. B. Hatch, president Johns-Pratt Company, Hartford, Ct.; C. W. Schultz, salesman, Philadelphia branch, Scranton, Pa.; G. A. Saylor, salesman, Milwaukee branch; H. R. Trainor, manager Boston branch.

The Lord Electric Company will be represented by F. W. Lord, president; E. M. Hamlin, F. W. Erickson and G. B. Crane, manager railway department. The company will exhibit the Shaw non-arcing lightning arresters and Thomas soldered rail bonds as described in Bulletins D and E. There will also be exhibited a comparatively new advertising device, consisting of a captive balloon from which is suspended an electric sign. This, it is believed will be particularly attractive to managers of street railway parks, as the sign can be made of sufficient dimensions to be visible for miles around. Another patented device which the company controls and expects to exhibit is a heat deflector in connection with electric car heaters. This device has received very favorable comment from traffic managers who have looked into the subject and appreciate the need of a device of this nature.

The Massachusetts Chemical Company will be represented by A. T. Baldwin, L. O. Duclos and A. E. Duclos, and will have a full line of samples, descriptive literature and souvenirs.

The National Carbon Company will be represented by N. C. Cotabish, sales manager; A. E. Carrier, manager New York office; A. C. Henry, F. D. Kathe, O. T. Weaver and Frank C. Park. The exhibition will consist of a miscellaneous assortment of various sizes of carbon brushes of different grades and textures.

The Ohio Brass Company will have an extensive exhibit which will include its line of overhead line material, car equipment specialties, etc. A full corps of representatives will be in attendance.

The Rail Joint Company will be represented by B. M. Barr, New York city; J. C. Barr, Boston, Mass; W. A. Chapman, Troy, N. Y.; G. M. Hagar, Chicago, Ill.; H. C. Holloway, Cincinnati, Ohio; J. A. Greer, New York city; G. W. Smith, Baltimore, Md.

The John A. Roebling's Sons Company will be represented by G. W. Swan and Albert Mann of the New York office, and A. P. Conover of the Chicago office.

The Speer Carbon Company will be represented by J. S. Speer, president and general manager, and G. P. Fryling, assistant secretary and treasurer. The company will exhibit its recently introduced reinforced carbon brush.

The Standard Varnish Company will exhibit a full line of insulating varnishes covering the requirements of dynamo, motor and transformer manufacturers. Various types of coils treated with electric railway varnish, "Voltalac" and other compositions will be shown. Samples of solid compounds designed for use in connection with vacuum drying and impregnating apparatus will be on exhibition. The company will be represented by John C. Dolph, L. Robinson and E. M. Heckscher.

The Sterling Varnish Company and the Pittsburgh Insulating Company, which are allied companies, will make a joint exhibition, showing various insulating varnishes, pole paints and car varnishes manufactured by the Sterling Varnish Company, and also the insulating linens manufactured by the Pittsburgh Insulating Company, using the products of the Sterling Varnish Company. The Sterling company will be represented by James Todd, president; Walther Riddle, Ph.D., vice-president; S. C. Schenck, general manager; A. S. King, eastern manager; C. L. Cool, manager of paint department; W. V. Whitfield and Charles A. Barker.

The Westinghouse companies will be represented by the Westinghouse Air-Brake Company, the Westinghouse Traction Brake Company, the Westinghouse Automatic Air and Steam Coupler Company, the Westinghouse Electric and Manufacturing Company and the Nernst Lamp Company. These companies will make their usual elaborate exhibit of

everything for the railway, from the track to the trolley wire.

The following manufacturers will also make extensive exhibits: Acme Supply Company, Addressograph Company, Adams & Westlake, American Locomotive Company, American Mason Safety Tread Company, American Blower Company, American Multigraph Sales Company, American Ferrofix Brazing Company, American Sewer Pipe Company, Atha Steel Casting Company, Atlas Railway Supply Company, Automatic Trolley Guard Company.

Bache Semon Company, Baldwin Locomotive Works, Ball & Wood, Bayonet Trolley Company, Berry Brothers, Bishop Gutta-Percha Company, L. M. Booth Company, J. G. Brill Company, Buhne Metal Packing Company, Burroughs Adding Machine, Burdett-Rowntree Manufacturing Company.

Emil Calman & Company, Carnegie Steel Company, Car Ventilating and Heating Company, Chicago Varnish Company, Climax Stock Guard Company, Compound Magnet Brake Company, Cooper Heater Company, Coin Counting Machine Company, Cook Standard Tool Company, Consolidated Car Fender Company, Consolidated Car Heating Company, Columbus Machine Works and Manufacturing Company, Curtain Supply Company.

Danville Company, Device Improvement Company, Doldt Coin Handling Machine Company, Dressel Railway Lamp Works, Duff Manufacturing Company, Durkin Controller Handle, D & W Fuse Company.

Charles I. Earll, O. M. Edwards Company, Egry Register Company, Electric Railway Improvement Company, Electric Traction Supplies Company, Electric Service Supply, ELECTRICAL REVIEW, Eureka Tempered Copper Works, Eureka Auto Electric Signal Company, Evans Almirall Company.

Flexible Compound Company, Franklin Car Heating Company.

Garlock Packing Company, Galena Signal Oil Company, General Electric Company, Globe Ticket Company, Gould Storage Battery Company, Gold Car Heating and Lighting Company, Grip Nut Company.

J. A. Hanna Company, Hale & Kilburn Company, F. P. Harrison Electrical Manufacturing Company, Haywood Brothers & Wakefield Company, Heany Fireproof Wire Company, Holophane Company, Holmes & Allen, Home Rubber Company, Howe Manufacturing Company.

International Register Company, *Industrial Magazine.*

H. W. Johns-Manville Company, Jones & Laughlin Company, P. S. Justice & Company.

Kalamazoo Railway Supply Company, Keystone Brake Shoe Company, Kenfield & Fairchild Publishing Company, Kinnear Manufacturing Company.

Lorain Steel Company, George W. Lord Company, Los Angeles S & S Company, Locke Insulator Company, Lumen Bearing Company.

John W. Masury & Son, Maryland Railway Supply Company, J. R. McCardell Company, McDonald Ticket and Ticket Box Company, McConway & Torley Company, Moran Flexible Steam Joint Company, Elmer P. Morris Company.

New York Car and Truck Company, National Brake and Electric Company, National Rail Road Trolley Guard Company, National Car Wheel Company, National Brake Company, National Lock Washer Company, Newman Clock Company, New Departure Manufacturing Company, Niles Car Works, Norton Grinding Company, R. D. Nuttall Company.

Ohmer Fare Register Company.

Palmetto Metal Company, Pantasote Company, Peerless Rubber Company, Pennsylvania Steel Company, Philip Carey Manufacturing Company, Philadelphia Air-Brake Machine Company, Pittsburg Insulating Company, Pittsburg Pole and Forge Company, Plomo Specialty Company, Pratt & Lambert.

Ramapo Iron Works, Railway Materials Company, *Railroad Gazette,* Recording Fare Register Company, Riverside Metal Company, Rooke Automatic Register Company, Russell Car and Snow Plough Company, Rubberset Brush Company, Railway Auditing and Inspection Company.

Samson Cordage Company, Schoen Steel Wheel Company, Security Register Company, Sherwin-Williams Company, Peter Smith Heater Company, Southern Exchange Company, Speer Carbon Company, Standard Motor Truck Company, Sterling Meaker Company, Standard Paint Company, Standard Steel Works, Standard Varnish Works, *Street Railway Journal,* Star Brass Company, Standard Roller Bearing Company, St. Louis Car Company, J. H. Symington Company.

Taylor Electric Truck Company, Traction Railroad Equipment Company.

Under-Feed Stoker Company, H. B. Underwood & Company, Union Electric Company, United Copper Foundry Company, United Uniform Company, United States Engineering Company, United States Metal and Manufacturing Company, United States Electric Signal Company.

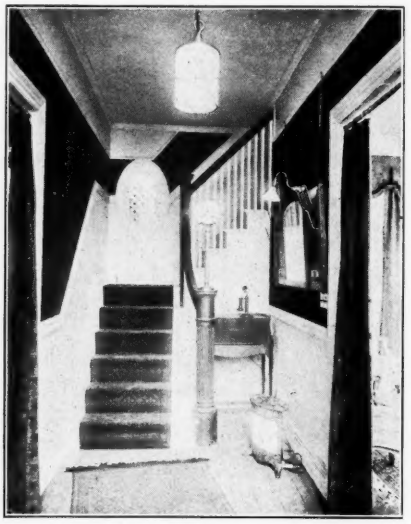
W. T. Van Dorn Company, Van Dorn Electric and Manufacturing Company.

Wallace Supply Company, Washburn Steel Casting and Coupler Company, Watson-Stillman Company, Walworth Manufacturing Company, Western Electric Instrument Company, Wendell & MacDuffie, Western Tube Company, Western Electric Company, Wheel Truing Brake Shoe Company, William Wharton, Jr., & Company, J. G. White & Company, Wilson Trolley Catcher Company, Wilson Company, Jas. E. Wilson Manufacturing Company.

Yale & Towne Manufacturing Company.

The New York Electrical Show.

The second week of the New York Electrical Show, which was held at Madison Square Garden, under the auspices of the Electrical Show, Incorporated, from September 30 to October 9, continued to draw large crowds every afternoon and evening. One of the spectacular and most interesting features of this show was the demonstration made by the Brooklyn Edison Company. A full report of the exhibitors and representatives in attendance was published in the ELECTRICAL REVIEW last week. Through the courtesy of the Edison Electric Illuminating Company of Brooklyn we are able to present this week several views of this company's installation, which gives a good idea of the gen-



A BROOKLYN EDISON STAIRCASE.

THE KITCHEN—SHOWING REFRIGERATOR, WASHING MACHINE AND BUFFERS.

eral character of the exhibit features. The accompanying illustrations show a general view of the Garden, a comprehensive view of the Brooklyn Edison display, and some of the individual rooms. This includes

A General View.—The "Brooklyn" Sign is One Hundred Feet Long and Twelve Feet High.

particularly the electric kitchen, showing the electric refrigerator, the washing machine and the motor-driven buffing and grinding machines; the staircase, showing the luminous radiator and the method of illumination, and the office and registry department, where the Brooklynites registered to receive one of the prizes which will be awarded to fifty lucky ones. The wide interest created by this exhibit is attested by the large number of prominent central station men who visited the exhibition and registered with the Brooklyn Edison during the show. Among these were the following: C. L. Edgar, president; I. E. Moultrop, superintendent, construction bureau; LaRue Vredenburgh, superintendent exhibition department; L. D. Gibbs, special agent Edison Electric Illuminating Company of Boston. T. R. Beal, secretary and manager Poughkeepsie Light, Heat and Power Company. E. O. Richards, superintendent Newburgh Light, Heat and Power Company. P. T. Glidden, vice-president and manager Binghamton Light, Heat and Power Company. Joseph B. McCall, president Philadelphia Electric Company. Alex Dow, vice-president Detroit Edison Company; president of the Association of Edison Illuminating Companies. Samuel Insull, president; L. A. Ferguson, vice-president Commonwealth Edison Company. F. M. Tait, general manager Dayton Lighting Company. C. R. Huntley, president Buffalo General Electric Company. J. Robert Crouse, Cooperative Electrical Development Association. W. C. L. Eglin, chief electrical engineer Philadelphia Electric Company. Henry L. Doherty, president Denver Gas and Electric Company. W. W. Cole, vice-president and manager Elmira Water, Light and Railroad Company. Homer E. Niesz, managing director Electrical Trades Exposition Company, Chicago. Walton Clark, vice-president; J. H. Whittlesey, chief engineer; Dudley Farrand, general manager; Percy Ingalls, treasurer, Public Service Corporation of New Jersey. General G. H. Harries, vice-president; E. S. Marlow, treasurer; L. E. Sinclair, general superintendent, Washington Railway and Electric Company. General F. E. Greene, vice-president Ontario Power Company. E. L. Davenport, general agent Narragansett Electric Lighting Company. A. B. Tenney, treasurer and general manager; H. T. Sands, manager Haverhill Electric Company. C. G. M. Thomas, vice-president and general manager New York & Queens Electric Light and Power Company. H. E. McGowan, general manager Flatbush Gas and Electric Company. George Bullock, president; E. E. Witherbee, manager

A Comprehensive View of the Brooklyn Edison Exhibit.

The Office and Registry Department.

United Gas Improvement Company. Joseph D. Israel, secretary and manager; P. H. Bartlett, B. J. Lockhart and H. M. Haffligh, Philadelphia Electric Company.

The United States Carbon Company did not fit up its exhibit in time to have a notice made of it in last week's issue. This company made a fine display of carbon products, showing particularly its carbon brushes for motors and dynamos. The company was represented by George W. Copley, managing director.

Notice was omitted of the fine display of Prometheus heating and cooking utensils at the booth of the United Electric Light and Power Company, and of the numerous pretty effects collated by the New York Electric Fountain Company.

Toward the end of the show an addition was made to the exhibit of the Beck Flaming Lamp Company in the shape of a 12,000-nominal-candle-power arc lamp, which was installed by the New York Edison Company on the corner of Madison avenue and Twenty-sixth street. This lamp was suspended about fifty feet above the street level from a small corner tower on the Garden, and illuminated a large section of Madison Square.

The very attractive exhibit of the National Electric Lamp Association was the centre of a great deal of interest. The new tungsten lamps burning horizontally were welcomed by the illuminating engineers, and this feature was greatly appreciated by the central station men who had the opportunity of examining these high-efficiency units.

At a meeting of the board of directors of the Electrical Show, Incorporated, it was announced that steps would be taken to provide an annual exhibit in New York city. President George F. Parker stated during the week that on the fourth day of the show a very practical success had been assured.

New York Edison Company Arranges a Course of Lectures in Electrical Engineering.

The New York Edison Company has arranged for a course of lectures in electrical engineering, to be delivered weekly by Professor Sydney W. Ashe, under the auspices of the Association of Employés of the New York Edison Company, in the auditorium at 44 West Twenty-seventh street. These lectures are open to all employés of the company, whether members of the association or not. Each lecture will be repeated so as to give both day and evening employés an equal opportunity to attend. The lectures will start promptly at 1.30 P. M. and 8 P. M. on the dates scheduled.

Annual Report of the Brooklyn Rapid Transit Company.

The annual report of the Brooklyn Rapid Transit Company for the year ending June 30, 1907, has been issued. A comparative statement of the results of the operation of the system for the years ending June 30, 1906, and June 30, 1907, is given below. The 1906 figures are omitted, but the increase or decrease over that year is shown in the case of each item, as follows:

	1907.	Increase or Decrease Over 1906.
Gross earnings from operation	$19,381,587.15	$908,259.05
Operating expenses.	11,465,704.76	1,024,327.39
Net earnings from operation	$7,915,882.39	—$116,068.34
Income from other sources	555,165.93	231,230.31
Total income	$8,471,048.32	$115,161.97
Less taxes and fixed charges	6,026,386.72	413,452.49
Net income	$2,444,661.60	—$298,290.52
Out of which was taken for betterments and additions to property.	442,063.37	—138,279.50
Surplus for the year.	$2,002,598.23	—$160,011.02
Add for judgment recovered from City of New York account wire privileges	39,798.33	39,798.33
	$2,042,396.56	—$120,212.69
Surplus for June 30, 1906-1905	2,075,562.81	1,090,839.61
Surplus June 30, 1907, and June 30, 1906	$4,117,959.37	$970,626.92
Of this amount there has been appropriated:		
Old accounts written off		$522.98
Depreciation adjustments	$12,127.65	12,127.65
For discount bonds sold	371,825.24	—199,421.42
Contingent reserve fund		—500,000.00
Total appropriations	$383,952.89	—$687,816.75
Balance surplus June 30, 1907, and June 30, 1906	$3,734,006.48	$1,658,443.67

The report states the following facts:

The percentage of operation to earnings is 59.16 per cent, as compared with 56.52 per cent for the former year.

The amount of surplus, after making all deductions, is $2,002,598, equal to 4.45 per cent on the capital stock of the Brooklyn Rapid Transit Company.

There were carried 511,839,437 passengers during the last year, an increase of 13.1 per cent over the previous fiscal year.

The average gross earnings per passenger are 3.60 cents, as compared with 3.89 cents for the preceding year, a loss per passenger of 7.5 per cent.

The average net earnings per passenger (with no deductions for special appropriations or fixed charges) are 1.48 cents, as compared with 1.70 cents for the previous year. This reduction in net per passenger is accounted for partly by the increase of 41.2 per cent in number of transfers collected.

The average number of cars operated daily for the twelve months ending June 30, 1907, is 2,093, as against 1,922 for the previous year, an increase of nine per cent.

The total passenger car mileage is 68,273,181, an increase of 4,615,858, or 7.2 per cent.

The number of (damage) cases disposed of during the year increased about thirty-six per cent (owing to the creation of several additional supreme and municipal court justices), which explains in large part the increase of 15.74 per cent in the item of damage and legal expenses.

Under the heading of additions to and improvement of property, it is stated that 100 elevated motor passenger cars have been ordered for delivery in the latter part of this year. One special steel motor passenger car has also been ordered as an experiment.

Convertible surface passenger cars to the number of 143 have been received and placed in operation and 100 closed surface passenger cars are now being received. These cars, by the removal of sashes, will be suitable for summer service.

Two 7,500-kilowatt turbo-generator units have been put in operation and five 10,000-kilowatt turbo units, together with all necessary equipment, have been ordered. Two of these will be put in service during the ensuing year. The extension of the power station to accommodate these new motors will be completed early in 1908.

The report also tells of the improvements made during the fiscal year which it covers, including new stations and the better equipment of the Brighton elevated line.

Proposed Magnetic Survey of Africa.

The Department of Research in Terrestrial Magnetism, in cooperation with Professor J. C. Beattie, of South African College, Capetown, is organizing a plan for the early completion of a general magnetic survey of Africa, according to *Terrestrial Magnetism and Atmospheric Electricity*. It is proposed to enlist the interest and assistance of the various nations concerned in Africa. The hope is entertained that the plan may be perfected in time to permit active work being begun in 1909 or possibly earlier. The work of the Department of Research will be restricted to such regions not likely to be undertaken by other organizations.

A Classification of Central Stations by States.

The accompanying table has been prepared by the Cooperative Electrical Development Association, Cleveland, Ohio. The figures are interesting as indicating the character of service in the towns between 1,000 population and 1,000,000 population. The statistics are given for purely electric central stations, for corporations supplying both gas and electricity, for corporations operating an electric light and power plant and railway, for corporations operating an electric railway and both a gas and electric light plant, and for purely municipal plants.

CLASSIFICATION OF CENTRAL STATIONS BY STATES.

PURELY ELECTRIC; GAS AND ELECTRIC; ELECTRIC AND RAILWAY; GAS, ELECTRIC AND RAILWAY; MUNICIPAL; 24-HOUR SERVICE AND NIGHT SERVICE—BASED ON McGRAW'S CENTRAL STATION DIRECTORY, MARCH, 1907.

1	2			3			4			5			6		
	Central Stations. Purely Electric.			Central Stations. Electric and Gas Corporations.			Central Stations. Electric and Railway Corporations.			Central Stations. Electric, Gas and Railway			Municipal Electric Plants.		
Population of Cities.	(A) Night Service Only.	(B) 24-Hour Service.	Total of A & B	(A) Night Service Only.	(B) 24-Hour Service.	Total of A & B.	(A) Night Service Only.	(B) 24-Hour Service.	Total of A & B.	(A) Night Service Only.	(B) 24-Hour Service.	Total of A & B.	(A) Night Service Only.	(B) 24-Hour Service.	Total of A & B.
1,000 and under	721	432	1,153	7	67	74	2	42	44	....	13	13	164	18	182
1,000 to 5,000	1,101	813	1,914	55	95	150	1	75	76	1	17	18	601	132	733
5,000 to 10,000	52	213	265	17	92	109	....	49	49	....	11	11	53	49	102
10,000 to 25,000	14	154	168	7	77	84	....	61	61	....	18	18	22	24	46
25,000 to 50,000	5	72	77	....	15	15	....	28	28	....	4	4	6	8	14
50,000 to 100,000	1	38	39	....	9	9	....	6	6	....	3	3	2	1	3
100,000 to 250,000	6	22	28	....	10	10	....	5	5	....	3	3	2	2	4
250,000 to 500,000	1	17	18	....	3	3	....	2	2	....	1	1	....	2	2
500,000 to 1,000,000	....	10	10	....	3	3	....	....	....	....	....	....	....	....	....
1,000,000 and over	1	7	8	....	5	5	....	1	1	....	1	1	4	1	5
Grand total....	1,902	1,778	3,680	86	376	462	3	269	272	1	71	72	854	237	1,091

PLANTS LOCATED IN CITIES TABULATED ABOVE—SERVICE BY OUTSIDE AGENCIES, CENTRAL STATIONS, TRANSMISSION LINES, ETC.

1,000 and under	126	264	390	4	66	70	1	34	35	....	12	12	4	5	9
1,000 to 5,000	65	217	282	7	60	67	....	46	46	....	17	17	4	4	8
5,000 to 10,000	2	29	31	....	13	13	..	9	9	....	2	2	....	....	....
10,000 to 25,000	....	18	18	....	3	3	....	3	3	....	....	....	....	....	....
25,000 to 50,000	....	2	2	....	....	....	....	2	2	....	....	....	....	....	....
50,000 to 100,000	....	1	1	....	....	....	....	....	....	....	....	....	....	....	....
Grand total....	193	531	724	11	142	153	1	94	95	....	31	31	8	9	17

Interchange of Traffic on Steam and Electric Roads in Indiana.

An important decision affecting both steam and electric transportation companies has been handed down at Indianapolis, Ind., by Union B. Hunt, chairman of the Indiana Railroad Commission, in deciding the case of the Farmland Stone Company *versus* the Cleveland, Cincinnati, Chicago & St. Louis Railroad and the Indiana Union Traction Company to compel an interchange of traffic at Winchester, Ind. This opinion was handed down on September 26.

The complaint alleged that the traction company had been unable to deliver cars of coal to the village of Farmland, the nearest station to the company's stone-crusher, which is located six miles from Winchester. The coal, according to the complaint, had been brought to Winchester by the steam road, and the plaintiff alleged that the latter refused to deliver the coal to the traction company, which, the complaint set forth, had been ready and willing to deliver to the stone-crusher.

In its answer to the complaint, the steam road alleged that the stone company was not entitled to the relief demanded, and that the railroad commission had no jurisdiction in the matter. The constitutionality of the law passed at the last session of the legislature, giving the commission jurisdiction in the case, was attacked.

Upon evidence being heard at Winchester on August 17, the facts as set forth in the complaint were demonstrated, and on September 26 the commission ordered the Cleveland, Cincinnati, Chicago & St. Louis Railroad to deliver the coal to the traction company.

The case is the first in which the question of an interchange of traffic between steam and electric lines has been raised before any railroad commission in the country. An interesting point in the opinion reads as follows: "Both the steam and the interurban railroads are common carriers under the laws of the state. They receive their charters from the state; they owe a duty to the public which must be discharged; and while not contemplating any general interchange of business between the steam and interurban railroads, the legislature, in its wisdom, foresaw that cases might arise where the public would need and demand such interchange, and evidently thought it should be given when it could be done without working hardship upon the carriers; hence it vested the commission with the discretion to require an interchange of business in such cases." The order entered by the commission provides that an interchange of traffic shall be established between the two roads by October 24. Each road is permitted to charge a reasonable switching rate for doing the work of delivery.

Supplies for the Navy Department.

The Bureau of Supplies and Accounts will open bids in Washington, D. C., October 15, for the following electrical supplies: nineteen induction motors and miscellaneous electrical supplies for delivery at Charleston, S. C.; 126 transformers for delivery at New York, N. Y.; 200 pounds of insulating tape for League Island, Pa.; fifty reels of miscellaneous wire for delivery at Charleston, S. C.

The bureau will open bids in Washington, D. C., on October 22 for 12,191 feet of rubber insulated cable, 100 pounds of gum-faced tape, 200 pounds of cloth insulating tape, six shell-type transformers, 7,489 pounds of wire, and miscellaneous knife switches and electrical supplies all for delivery at Norfolk, Va.

Electrical Notes from Great Britain.

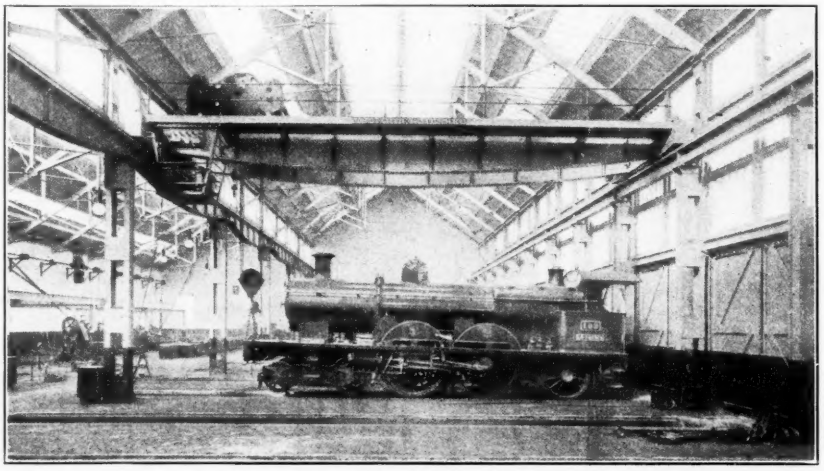
(From Our British Correspondent.)

J. S. HIGHFIELD, the engineer of one of the largest and most successful London electric light and power systems (the Metropolitan Electric Supply Company, Limited), and inventor of the Highfield booster, has written to me expressing his opinion concerning the probable effect of metallic filament lamps upon our central station systems, in the following terms:

"Assuming the price of metallic filament lamps be reduced to, say 1*s.* 6*d.* and the efficiency to be, say, three times that of the carbon filament lamp, in my opinion the first effect would be to greatly increase the use of electric light, but not at such a rate as to maintain the existing revenue. I believe, however, that the ultimate effect would be to make electric light almost the universal light at a somewhat higher price per unit than now obtained."

The accompanying photograph shows a thirty-ton, overhead, three-motor electric traveling crane which was not long since put into service at the new repair shop of the Great Western Railway Company, at Old Oak Common. The span is forty-nine feet centre to centre of gantry rails, and the height twenty-three feet one inch from the floor to gantry rail level. The crane is shown lifting the engine "La France." The speeds are: longitudinal travel 250 feet per minute, and the cross traverse eighty feet per minute, light; hoisting thirty tons, at four feet per minute, slow gear; fifteen tons at eight feet per minute, quick gear; six tons at twenty feet per minute, small barrel. The motors are multipolar, totally enclosed, series wound, special crane service type, working at 600 volts, continuous current. The motor speeds and powers are: longitudinal travel, eight to sixteen horse-power, 760 to 500 revolutions per minute; cross traverse, four to eight horse-power, 380 to 250 revolutions per minute; hoisting, thirteen to twenty-six horse-power, 400 to 275 revolutions per minute. In regard to rating, the makers have worked to the following: The lower powers at the higher speeds for one hour continuous; the higher powers for ten to fifteen minutes. There is a powerful automatic brake with electromagnetic release embodied in the hoisting gearing, and a patent automatic circuit-breaker is incorporated for the prevention of overwinding and also of overlowering. As part of the electrical equipment there are fixed on the crane girder a double-pole main switch; three double-pole fuses, enclosed each in a separate compartment, to fuse if current through any motor exceeds the safety limit; a pilot lamp to indicate whether current is on or off, and a portable hand lamp with a flexible conductor, for examination of the crab, and a cast-iron box for its safe storage. The crane is built by Vaughan and Son, Limited, of Manchester.

It will be remembered that Messrs. Yarrow & Company of Poplar, London, announced some time ago their intention of removing their shipbuilding and engineering yards out of London because of high rates, high wages and so on in the Poplar district. After considering many likely localities the directors fixed upon Scotstown in the Clyde Valley, in Scotland, and the works are now being laid out. Electricity will, of course, be very largely used in the operation and lighting of the works. All the tools in the pattern makers' and joiners' shops are to be electrically driven by means of motors situated beneath the level of the floor. Many electric cranes, both large and small, are being fitted up inside the different shops, and for the fitting-out basin. The latter has a fifty-ton traveling crane with a span of ninety-three feet, and there is one of the same size, as well as some of smaller sizes, in the different engineers' shops. The equipment of the boiler shop includes one of fifty tons and one of ten tons, while between this shop and the platers' department there is a large gantry 330 feet in length, with an eighty-five-foot span, carrying a seven-ton electric traveling crane. All the energy necessary for the Scotstown works is to be derived from the supply system of the Clyde Valley Electric Power Company. This company has two generating stations at present, one at Yoker, started in 1905, and the other at Motherwell, which commenced running early last year. An 11,000-volt, three-phase current, twenty-five periods, is generated; this being transformed down to 400 and 230 volts for consumers' purposes.



Overhead Electric Traveling Crane in Old Oak Common Repair Shop, Great Western Railway.

Dunrobin Castle in Sutherlandshire, a fine property of the Duchess of Sutherland, has just been installed with an electric lighting and heating plant. The suction gas producer plant which has made electric lighting installations possible for a number of small localities and many private residences which would have had to wait but for its availability, has also been adopted for this fine stately castle. The installation consists of two large suction gas engine sets (multipolar generators) and a battery of accumulators.

Electrically driven fans, electrically heated hot-plates and so on are used, and an interesting feature met with here as in so many other palatial residences in England and Scotland, is the adaptation of the fine candelabra in the dining and drawing rooms and on the staircase, which did service so long for old-fashioned illuminants, for electrical lighting. It is stated that the electric lamps put in have by the Duchess' special desire been made of exactly the same shape and color as the wax candles formerly used. From the power-house in the grounds the current is conveyed by means of underground cables to the laundry, the estate workshops, and the castle buildings. The firm of Claud Hamilton which has done a good deal of work of this class, put in the entire installation, and it has also lately put one into the Duke of Portland's mansion in the north of Scotland (Langwell House, Berriedale).

The annual report of the Postmaster-General which has been issued this week, contains some interesting figures relating to the telegraph, telephone and wireless systems of the British Government. Some 1,140 outward and 15,853 inward wireless telegrams were transmitted, during the year ended March, 1907, to and from ships in connection with the Marconi Company's service. The figures in the preceding year were 558 outward and 11,094 inward. It seems that in addition to the wireless telegraph licenses already in force, some forty-five new applications were lodged, and of these the postmaster granted thirty-six for experimental use, the others having been deferred until the subject of the International Convention was finally settled. The number of telephone trunk wire centres has been increased from 487 to 533 during the year, 288 new trunk circuits being provided, making a total of 2,043 with 73,000 miles of double wire. Important work is proceeding on the extension of the underground telegraph system of the country. It is shown that the cost (average) of constructing an exchange circuit in the London metropolitan area is £33 5*s*. 2*d*, and including all spares the capital expenditure per station stands at below £50. Between now and 1911 (the year when the Government takes over the National system), the post-office will, according to present estimates spend £6,000,000 upon telephone extension.

Some attention is being devoted to a scheme of cooperation that has been put forward by C. S. Northcote, of wholesale electric traders, by means of which it is designed that electric light and power authorities, electrical manufacturers and contractors shall cooperate in buying and selling electrical material, in pushing the advertising and sale of electricity for all purposes, in the hope of lessening competition, increasing profits, and by reducing the expense of installation and energy to the consumer produce a bigger electrical development than obtains at present. One part of the scheme is that those who enter into the organization, if formed, shall, if they be contractors or electricity suppliers who can foretell the probable demand for electrical material and "supplies" requirements, send intimation to a central buying headquarters which in this way will have large orders to place with its own manufacturing members at such time and in such bulk that by a more regular distribution of manufacturing operations over the different months of the year, they may produce at lower cost, making a better profit and selling to the contractor or consumer at a less rate. Another item in the proposal is the setting up of a big permanent exhibition where the manufactures of its various members would be displayed and where the probable or intending consumer can go and select whatsoever he may require or whatsoever may suit his mood or fancy.

It is probable that in regard to modern publicity work by means of literature advertising and exhibition work the varied interests might be profitably brought together for the purpose of joint action for the good of all, but we are afraid that the cooperation between manufacturing and other interests named above, in buying and selling, is a dream that is impossible to carry out in England, at any rate at present, however much British electrical industry, in certain of its departments at least, may be in need of better prices and reduced competition. As we say, the subject is now under consideration, and it will be interesting to see how the proposal is received.

If there is one thing that seems to be becoming more and more certain, it is that the publicity methods that have operated so successfully in the States will not fit in with British ideas. Perhaps among the reasons for this may be the fact that we have not given them a fair or sufficiently extensive trial. Or it may be due to the inherent prejudices of the Britisher. Many men are trying their own particular notions upon the residents in their own particular districts. It has to be proved whether this distribution of varied initiative and enterprise in publicity is better as regards effect upon the public mind than a less costly, better organized and perhaps centrally guided and controlled system of greater uniformity would be. An argument that is used against uniformity is that each district requires its own particular treatment, and only the man who has lived in it and rubbed shoulders with its residents, can make out a suitable prescription to cure the gas complaint or affection. But no doubt practice will prove that a centralized body may, advantageously for all, make for unity of action in regard to many points, without interfering with the free play of local knowledge.

The second annual Engineering and Machinery Exhibition at Olympia was opened on Thursday, September 19, by Sir Alexander B. W. Kennedy. It will remain open for one month. It is a far more interesting, representative and complete exhibition than was that held at the same place this time last year. A number of semi-popular lectures on engineering subjects will be delivered in one of the side halls during the run, one of these being by Charles Bright on "Submarine Telegraphy." There will be specially arranged students' and workmen's visits so that men in these classes may derive educational benefit from the show. The exhibition is in only a very limited degree of electrical interest.

ALBERT H. BRIDGE.

London, September 26.

Western Union and Postal Attacked by New York State Attorney-General.

Justice Ford, in the Supreme Court, has signed orders at the instance of New York State Attorney-General Jackson, directing the Western Union Telegraph Company and the Postal Telegraph-Cable Company to show cause in the Supreme Court why he should not have permission to sue them for forfeiture of their charters.

The Attorney-General sets forth in his petition that the two companies on January 1, 1907, entered into a combination by which they adopted a new schedule and increased the tariff rates of messages from this city to other points in the United States and from other points in the United States to this city. He says they also agreed to maintain joint offices in certain cities and towns and to divide the proceeds. He also said that by the agreement the two companies agreed to maintain offices in certain hotels and public buildings in New York city, and to share the gross receipts equally. He says that this agreement is unlawful.

On Friday of last week Justice Seabury adjourned until October 10 the hearing on the Attorney-General's application.

Norwegian Nitrogen Manufacture.

In transmitting to the Bureau of Manufactures some trade literature upon the oxidation of the nitrogen of the air and the production of nitric acid by electric explosions and subsequent chemical processes as commercially practiced at Nottoden, in Norway, under the Birkland-Eyde process, Herbert H. D. Peirce, American minister at Christiania, writes:

"I have recently visited these works where, although the entire plant is not as yet in operation, nitrate of lime and soda are being manufactured upon a commercial scale, namely, about 1,000 tons a year, with the expenditure of about 2,000 electrical horse-power. This plant has been in operation now for several years, and it is by reason of the success of the smaller plant that Mr. Eyde, the manager of the undertaking, has brought a large amount of French capital to his assistance for the larger enterprise. Mr. Eyde is himself the engineer who has worked out the various problems as they have presented themselves in this new and interesting process, starting only with the powerful electrical flame invented by Professor Birkland in his experiments with his electrical gun.

"Upon the demonstrated commercial success of the process in the smaller plant work was at once commenced upon the construction of the new and large plant which was to be in operation by the first of September with a force of some 40,000 horse-power furnished by taking the water of the Tinfos, a waterfall at about three miles from the actual works.

"The construction of the dam and the conduits, which are tunneled through the solid rock for the distance of 230 feet, and of the power-house in the narrow gorge at the foot of the fall, all presented engineering problems of great difficulty, which have been skilfully handled. The construction is of concrete throughout.

"The output of the new works when the water is turned on to the turbines will be about 20,000 tons of basic nitrate of lime per year. This article finds a ready market, especially in Germany, as a fertilizer. The company now finds it worth its while to convert a part of its production into nitrate of sodium, which is used in connection with certain dyeing processes. At the time of my visit the management was also in negotiation with certain capitalists for the production of concentrated nitric acid.

"Not content with these works, the company is now constructing a dam at the Rjukanfos, one of the most important waterfalls in Norway, where a power plant of 250,000 horse-power will be erected, taking the whole of the water from the falls, and electrochemical works for the utilization of this great power will be built and operated. The concessions for these operations were obtained some years ago, but at present the Norwegian Storthing appears to look with alarm at the acquisition by foreign capital of the water powers of the country and has passed laws which are practically prohibitive of future undertakings of this sort by foreign capital. As local capital for such enterprises could hardly be got together in sufficient amounts, the further developments of the Norwegian water powers upon a large scale will doubtless be checked for some time."

Consul-General Henry Bordewich, of Christiania, responding to an inquiry from Michigan, also sends an account of the operations at the Eyde plants and of the process employed, as follows:

"Two distinct stock companies have been formed, but both are under the same management. One is styled the Norwegian Power Stock Company (Norske Kraftaktieselskab), the capital is 16,000,000 kroner, or $4,288,000, having for its object to manipulate and utilize water powers and everything connected with such. The other is styled Aktieselskabet de norske Saltpeterverker (The Norwegian Saltpeter Works Stock Company), the capital is 18,000,000 kroner, or $4,824,000, its object being the manipulation and utilization of chemical industry and everything connected therewith.

"Regarding the method by which the Birkland-Eyde lime saltpeter or calcium nitrate is produced, it should in the first place be noted that it is a new way of utilizing electricity, although it is a succession of the experiments which the English physiologist, Cavendish, made in the eighteenth century, by which he produced combinations between the nitrogen and the oxygen of the atmosphere by letting electrical discharges pass through the air during the presence of a decomposition of alkali, and whereby he succeeded in producing small quantities of nitric acid. The Birkland-Eyde method is in principle the carrying out on a larger scale of the same process as Cavendish started on a smaller one, with this difference, however, that Birkland and Eyde have introduced new auxiliaries, which in themselves constitute highly original discoveries.

"First and foremost is the electrical furnace, which is the fundamental element of the whole process. Into this furnace passes atmospheric air, where it is speedily heated to a very high temperature, presumably about 3,000 degrees Celsius, inasmuch as inside the furnace are placed two electrodes, separated by a distance of a few millimetres (millimetre=0.0394 of an inch), and through these two electrodes there runs an alternating current of 5,000 volts. In order to strengthen the effect of the electrical discharge on the air and the further oxidation of the nitrogen, stress has been laid on giving the heat-producing arch flame the largest surface possible. In a clever way the formerly known form-alteration, which the arch flame becomes subject to when influenced by a magnet, has been utilized to further this end, as the two electrodes are placed between a powerful electromagnet, deriving its energy through an even current.

"By this method the arch flame is subjected to a series of very rapid displacements in a plane, which stands vertical on the line between the poles. The final result is the formation of a disc-shaped electric flame, which reaches a diameter of 1.8 metres (meter=39.37 inches). The air sweeps this flame disc on both sides and is thereby momentarily heated to the very high temperature which is required for the oxidation of the nitrogen. Immediately thereafter the gas escaping from the furnace must again be cooled down to 600 degrees in order to avoid loss of nitrogen; but as this temperature is also too high for the apparatus which thereafter are to receive the gases, they have to be still further cooled.

"The gases are thereafter led to a series of towers, the so-called oxidation towers, and from there to the so-called absorption towers, which are built partly of granite, partly of wood, and where the gases are led over limestone sprinkled with water. There is now only left the concentrating of the decomposition by steaming, and this is done in large pans, first by the aid of steam and later by direct heating by coal. The mass is steamed to a fusing point of 145 degrees and is thereafter poured into tin cylinders, where it congeals by cooling. In this form the product is sold to manufacturers of chemicals. They prize the product highly on account of its purity.

"For fertilizing purposes the product is broken into the form of powder, and this stuff, which now holds 12.75 to 13 per cent of nitrogen, is the so-called lime saltpeter or calcium nitrate. It is a stuff much like salt, easily dissolvable in water, possessing hygroscopic qualities, wherefore it has lately been produced in melted form and thereafter in frumentaceous or

grainy form. This latter form of the product is that in which it now is sold to the trade, and in this form alone it will be on the market in the future. It is shipped from the factory in wooden barrels, lined inside with paper.

"The problem of manufacturing nitric acid and saltpeter from the nitrogen in the atmosphere is thus solved. At the Notodden saltpeter factory the stage of experiments is passed, and the realization of manufacture is reached. Still the industry is only in its infancy.

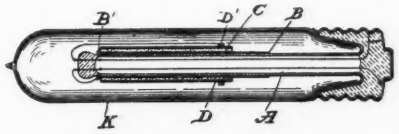
"The electric energy is as yet furnished by the power station at Tinfos, where a three-phased generator of about 2,000 kilowatts is erected for the production. The power is utilized by three electrical furnaces with 500 to 700 kilowatts to each, respectively 700 to 1,000 horse-powers. Under work of regulation is the so-called Svälgfos, which is expected to be able to produce 20,000 and 30,000 horse-powers, and finally is projected the regulation of Rjukanfos, which with a waterflow of forty-five cubic meters (cubic meter =35.316 cubic feet), and a fall of 550 meters will give about 220,000 effective horse-powers. The production on a large scale will begin, and then the product will have to be offered in the world's markets. It will not be accompanied with much difficulty to introduce it there, because the world's demand for nitrogen is large and rapidly increasing, both for agricultural and industrial purposes. The only question that presents itself, is the Norwegian lime saltpeter suitable as a fertilizer, and is it equal to the Chilean saltpeter?

"The experiments so far, made partly in Norway, partly in Sweden, Denmark, Germany and France, seem with certainty to prove that lime saltpeter not only holds its place alongside Chilean saltpeter as a fertilizer, but that by its possession of lime it has certain advantages over Chilean saltpeter, especially on soil poor in that respect."

A New Selenium Cell.

An interesting patent for a new type of selenium cell was issued to William J. Hammer, of New York city, September 17. In this cell the inventor has introduced several novel features, each of which has a specific purpose. The cell is, of course, designed for use in an electric circuit, a portion of which is to be made sensitive to changes in illumination, and the object of the invention was to provide a cell permanent in its characteristics and mechanically strong, so that it could be handled easily, and readily inserted or withdrawn from the circuit. The cells heretofore constructed have been delicate, and required most careful handling, and often not sufficiently protected from outside influences. In order to overcome the last trouble, such cells have frequently been enclosed in glass vessels, the object being to transmit light to the cell, at the same time to protect it from moisture and other atmospheric influences. Glass, however, is practically opaque to the higher radiations, and hence, used in this way, screens the cell from such radiations, although they may be present in fairly large proportion, and should be allowed to fall upon the cell in order to produce a corresponding effect.

The form of cell devised by Mr. Hammer is shown in the accompanying figure. This, of course, may be varied although the essential features are not changed. In this figure there is a central tube, A, of fused quartz, this material being employed because it may be heated to a high temperature and cooled rapidly without breaking, and in doing this its low co-efficient of expansion does not injure the layer of selenium placed around it. This tube is coated with metal foil, B, usually thin so as to avoid strains upon the selenium due to expansion and contraction during the forming process. In some types, if desirable, this inner layer of metal may be made thicker and constitute the supporting element.



SELENIUM CELL.

Upon this metal foil, the selenium, C, in pasty form, is spread out uniformly in any convenient way, which may be by rolling the tube thus coated between glass plates, thus securing a smooth compact and highly polished layer. Over this layer of selenium, a very thin metal foil, D, is placed. The material may be gold, silver, or, better still, aluminum. This film should be so thin that it is transparent to light, and for this aluminum is particularly useful because of its white color and the tenuity of the films which may be formed. The element, if thus constructed, consists then of two films of metal separated by a layer of selenium and carried on some support. In practice it is desirable to use metal films with thickened ends, as shown at B' and D' in the figure, so that good electrical connection may be made to them.

The element thus constructed is then heated to the necessary temperature in any way, such, for example, as holding it over a Bunsen flame and letting the latter pass up through the quartz tube. After the necessary temperature has been reached, the element is removed from the flame and allowed to cool. It is then placed within a bulb, K, sealed in after suitable connecting wires have been brought out and the bulb is exhausted. This removes any moisture which might be in the tube, and any gases occluded in the element. The best form of tube is one of quartz glass, since this is transparent to the short wave-lengths of light, but a cheaper form may consist of a glass bulb into which a quartz window has been fused.

With this form of element there is a continuous layer of selenium in the sensitive condition between the two sheets of metal, which, the inventor says, is much better than imbedding two parallel wires in a layer of selenium. Frequently in cells of the latter type, the selenium is supported on metal which acts as a shunt to it, and thus reduces its sensitiveness. The cell, as just constructed, is inserted in series in the electric circuit. With a cell constructed in this way a smaller amount of selenium may be used and still give a cell more sensitive than the older types, and since the entire current passes through the light sensitive substance, there being no shunting support, the sensitiveness and accuracy of the cell are increased.

The protection of the cell as described renders it independent of outside influences, and thus makes it a permanent device.

It is interesting to note in this connection Mr. Hammer's contention that there is no such thing as "photoelectric action" of the selenium cell. That is, if one puts a cell in circuit with a galvanometer, and allows a light to fall upon it, no deflection is obtained, as has been asserted; in other words, there is no electromotive force set up. The effect of the light is merely to change the resistance of the selenium layer so as to allow a larger current, supplied from some other source, to flow through the circuit.

There is one advantage of this type of cell worth mention, that is, by the use of gold, silver, or aluminum for the metal foils, no chemical action takes place, since these metals do not react with the selenium as do copper and certain other elements, and this, of course, destroys the permanency of the cell.

Tests of Internal-Combustion Engines on Alcohol Fuel.

A bulletin, No. 191, giving the results of tests of internal-combustion engines on alcohol fuel, has been issued by the United States Department of Agriculture. This has been prepared by Dr. C. E. Lucke, professor of mechanical engineering of Columbia University, and S. M. Woodward, irrigation engineer.

These tests were conducted in order to obtain information for which many demands were made upon the department, and because there was a complete absence of accurate and detailed data on the subject of alcohol fuel in the English language. As the supply of crude oil to be obtained in the United States must ultimately diminish, a possible substitute for petroleum fuels will become of increasing importance as time goes on, as the prices of petroleum products will, it may be presumed, continue to increase while, by improvements in the process of manufacturing, the cost of alcohol should fall.

The tests described in this report were made in New York city in the mechanical engineering laboratories of Columbia University, from October, 1906, to February, 1907. The object of this investigation was, first, to determine whether the gasolene and kerosene engines, at present on the American market, can be run using alcohol as the fuel. This involved, after relating matters, the determination of the manipulation to be followed in running the engines on alcohol, the measurement of relative and maximum powers of the engines when using alcohol and the fuels for which they were originally made, and the relative consumption of the different fuels.

The second object of the investigation was to determine, as far as possible in the time available, the improvements which might be desirable in the design of engines manufactured especially for alcohol.

The tests were conducted on eight engines varying in output from two to forty horse-power, and designed for gasolene or kerosene. On each engine a number of tests were made.

Before describing these various tests, which is done in detail in the bulletin, the results being given in both tabular and graphical form, the engines being described, and frequently details of parts shown, the properties of liquid fuels are discussed. Gasolene and kerosene are most easily examined by their specific gravities, but since each is a mixture of numerous lighter and heavier oils, a definite constant density is not a guarantee that the combustion may not change sufficiently to affect the action of the fuel in an engine. Commercially pure grain or ethyl alcohol is sensibly pure except for the water which may be mixed with it, hence a specific gravity test is a pretty fair indication of the purity of the fuel. The strength of the alcohol is usually given by stating the percentage of absolutely pure alcohol by volume which exists in the mixture of alcohol and water.

The heat of combustion of alcohol, determined experimentally, is about 12,700 British thermal units per pound. The heat of combustion of the various petroleum oils varies between 19,000 and 21,000 British thermal units, and 20,000 is used as its average value. Since the combustion of these fuels produces water vapor which passes off as steam, it is necessary to deduct from the values given the heat required to vaporize the water. When this is done, the value given is called the "low value of heat of combustion." Theoretically, complete combustion of one pound of alcohol requires 2.086 pounds of oxygen or 9.06 pounds of air equivalent to about 119 cubic feet of pure air at a temperature of sixty degrees at sea-level. If water is present, less air is, of course, required. In an actual engine, the amount of air is proportioned to the amount of vapor, not by any exact measurement, but by trial to secure either the best results in maximum power or in minimum fuel consumption. Usually, the engineer operating the engine has no means of determining what proportion of air he is supplying.

The following are the conclusions drawn from the tests described in this bulletin:

Any gasolene engine of the ordinary types can be run on alcohol fuel without any material change in the construction of the engine. The only difficulties likely to be encountered are in starting and in supplying a sufficient quantity of fuel, a quantity which must be considerably greater than the quantity of gasolene required.

When an engine is run on alcohol its operation is more noiseless than when run on gasolene, its maximum power is usually materially higher than it is on gasolene and there is no danger of any injurious hammering with alcohol such as may occur with gasolene.

For automobile air-cooled engines alcohol seems to be especially adapted as a fuel, since the temperature of the engine cylinder may rise much higher before auto-ignition takes place than is possible with gasolene fuel; and if auto-ignition of the alcohol fuel does occur no injurious hammering can result.

The consumption of fuel in pounds per brake horse-power, whether the fuel is gasolene or alcohol, depends chiefly upon the horse-power at which the engine is being run and upon the setting of the fuel supply valve. It is easily possible for the fuel consumption per horse-power-hour to be increased to double the best value, either by running the engine on a load below its full power or by a poor setting of the fuel supply valve.

These investigations also showed that the fuel consumption was affected by the time of ignition, by the speed, and by the initial compression of the fuel charge. No tests were made to determine the maximum possible change in fuel consumption that could be produced by changing the time of ignition, but when near the best fuel consumption it was shown to be important to have an early ignition. So far as tested the alcohol fuel consumption was better at low than at high speeds. So far as investigated, increasing the initial compression from seventy to 125 pounds produced only a very slight improvement in the consumption of alcohol.

It is probable that for any given engine the fuel consumption is also affected by the quantity and temperature of cooling water used and the nature of the cooling system, by the type of ignition apparatus, by the quantity and quality of lubricating oil, by the temperature and humidity of the atmosphere, and by the initial temperature of the fuel.

It seems probable that all well-constructed engines of the same size will have approximately the same fuel consumption when working under the most advantageous conditions.

With any good, small stationary engine as small a fuel consumption as 0.70 pound of gasolene, or 1.16 pounds of alcohol per brake horse-power-hour may reasonably be expected under favorable conditions. These values correspond to 0.118 and 0.170 gallon respectively, or 0.95 pint of gasolene and 1.36 pints of alcohol. Based on the high calorific values of 21,120 British thermal units per pound of gasolene and 11,800 per pound of alcohol, these consumptions represent thermal efficiencies of 17.2 per cent for gasolene and 18.5 per cent for alcohol.

But calculated on the basis of the low calorific values of 19,660 British thermal units per pound for gasolene and 10,620 for alcohol, the thermal efficiencies become 18.5 for the former fuel and 20.7 for alcohol, The ratio of the high calorific values used above is, gasolene to alcohol, 1.78. The corresponding ratio of the low calorific values is 1.85. The ratio of the consumptions mentioned above is, alcohol to gasolene, 1.66 by weight, or 1.44 by volume.

BOOK REVIEWS.

"How to Design a Gas Engine." Horace Allen. Manchester, England. Scientific Publishing Company. Cloth. 40 pages. Illustrated. 7½ by 10 inches. Price, 2s. 6d.

This book gives a discussion of the design of small gas engines, particular reference being made to one of seven horsepower, full working drawings for which are given. The subject is treated in a simple manner so that any competent machinist could build the engine from the description here given.

"Railroad Men's Catechism." Angus Sinclair. New York. Angus Sinclair Publishing Company. Flexible cloth. 200 pages. 4¼ by 6½ inches. Furnished by the ELECTRICAL REVIEW for $1.

This book has been prepared for the instruction of engineers and firemen employed by steam railroads. The matter is presented catechetically, and the book takes up all the various duties which these men are called upon to perform, including care of the locomotive, train and the signals employed in railway work.

"A First-Year Course of Practical Magnetism and Electricity." P. E. Shaw. London. Electrician Publishing Company. Cloth. 66 pages. Illustrated and interleaved with blank pages. 5½ by 8½ inches. Price, 2s. 9d.

This is an elementary treatise on electricity and magnetism the method employed being to depend largely on experiment and to avoid mathematical symbols. On the other hand, it is sought to avoid the carelessness of thought and methods which result from purely qualitative studies and the need for exactness in laboratory work is emphasized. The ground covered is that usually gone over in the first year of college physics.

"Polyphase Currents." Alfred Still. New York. The Macmillan Company. Cloth. 352 pages. Illustrated. 5¼ by 7½ inches. Furnished by the ELECTRICAL REVIEW for $2.50.

This book has been prepared to supply a non-mathematical treatment of polyphase currents. In it the author makes extensive use of graphical methods, these methods being thoroughly explained in the introductory chapters. The aim has been to make it possible for a student with a fair knowledge of continuous-current working to obtain a thorough grounding in the principle underlying polyphase working, if he will study this book carefully. The ground covered is that generally gone over in such text-books, including a discussion of the characteristics of alternating-current circuits, the construction of polyphase currents and the peculiar effects obtainable by means of them, and the characteristics of alternating-current apparatus. The principles employed in the design of transmission lines are discussed, and also the various special appliances found necessary for certain apparatus, such as the starting and regulation of induction motors, synchronizing alternators and compensated polyphase motors.

"Economics of Railroad Construction." Walter Loring Webb. New York. John Wiley & Sons. Cloth. 339 + viii page. Illustrated. 5½ by 8½ inches. Furnished by the ELECTRICAL REVIEW for $2.50.

Concisely characterized, Webb's "Economics of Railroad Construction" presents in a simplified, very much condensed, and also modernized form the essential teachings of Wellington's monumental "Economic Theory of Railway Location." It is not a substitute for the latter; we have still to wait for a book to take its place. But Webb is superior to Wellington in at least one point: it can be read with understanding and profit by great numbers of men who are unable to follow attentively through the lengthy and discursive windings of the older text. There are also new phases considered, and new figures presented; but the differences from the model are less significant than the similarities. The logical appraisement of the traffic-producing capacity of a proposed line, and of the cost of distance, curvature and grade, are the central features of the text. The book is one that should be read not only by railway engineers, but also by the engineers concerned in the construction of electric suburban and interurban lines. If the latter class of readers will give to the subject the consideration and study that it merits, it may in the future be possible to develop principles and figures for electric lines corresponding to those for steam-operated railways as discussed in the work under review

"Brakes for Tramway Cars." Henry M. Sayres. London. Electrician Printing and Publishing Company. Cloth. 76 pages. Illustrated. 5½ by 8½ inches. Price, $1.50.

The author in this book first discusses the importance of the braking equipment of street railway cars. He points out that this part of the equipment is as important as the driving part, although the latter has received the greater attention from engineers. He divides the work of the brake into two categories: Service stops and emergency stops. The conditions to be met in the former are fairly calculable; those arising when an emergency stop is to be made can not be foreseen. For this reason the driver of the car should be thoroughly familiar with his emergency brake—in fact, the brake used for making emergency stops should be that which is used for ordinary work, and the man should become so familiar with it that to prevent an accident he uses it automatically by an acquired reflex action. The author points out the necessity for mechanical brakes on high-speed heavy cars, but he says that the installation of such brakes on city cars, where speeds are low, is not always justifiable. The different types of mechanical brake are described, then electrical brakes are taken up and fully discussed. These brakes include those which use the motor for braking, and those which make use of the special appliance, such as a magnetic track brake. The latter part of the book is given up to the discussion of the methods of adjusting and maintaining brakes. In a general summary the desirable features of brakes which should be borne in mind when making a selection are repeated. The braking apparatus has always lagged behind the driving apparatus, and naturally so; but in case of electric driving this is particularly noticeable, because the system of driving thus affords excellent ways of stopping a car. This has been realized by many engineers, and a variety of systems has been devised, but their use is as yet limited. The discussion of the problem given by Mr. Sayres should encourage the introduction of power brakes of some kind on all heavy high-speed cars. For interurban work they are a necessity, and are now generally used. In city work, they are less used, but their value in assisting a car through a crowded street and the confidence which they give the motorman can not be easily overestimated.

Bell Telephones to Be Placed on Market.

An important change in the policy which the Bell Telephone Company has maintained for thirty years became known when President Theodore N. Vail, of the American Telephone and Telegraph Company, said that the Western Electric Company, which manufactures the apparatus used by the Bell companies, would hereafter sell telephones and supplies to all buyers. Heretofore the Western company has refused to sell its instruments to independent companies, partly, Mr. Vail said, because the full resources of the Western plant were required to supply the demands of the Bell companies.

Now that large additions have been completed to the Western company's plant at Chicago, that company is able to take care of outside orders.

The Permeability of Concrete, and Methods of Waterproofing.

In the *Engineering News* for September 26 a paper entitled "The Permeability of Concrete, and Methods of Waterproofing" is presented by Richard H. Gaines, chemist to the New York State Board of Water Supply. This paper is the result of an investigation now being carried on by the board, and is a part of a report presented to the American Society of Civil Engineers. The significance of the paper to electrical engineers is in the method of analysis by which new principles were deduced for the preparation of the concrete, lessening its permeability and making it effectually proof against the percolation of water. Mr. Gaines has based his experiments on the application of the electrolytic theory, and has worked out some interesting and important ideas by assuming that the decomposition reactions in cement would be augmented by replacing the mixing water with a dilute solution of a suitable electrolyte, some substance the free charged ions of which would bring about a rearrangement of the molecules of the bodies with which they came in contact, causing a complete change in the equilibrium conditions of the system.

It has long been known that when certain finely powdered minerals are treated with water, reactions take place which result in partial decomposition. Investigation with the microscope has shown that water produces a colloid or glue-like surface condition of the particles, leading to plasticity in the wet mass and increasing the binding power, or induration. The last change is due to the surface of the particles becoming clogged with the product of hydrolytic decomposition. The general process is similar to what follows mixing water with cement, but the reactions go further in the latter case.

The complex series of changes that take place in cement by the electrolytic dissociation theory leads to the conclusion that the following consecutive processes take place in the wet mass:

1. Hydrolytic dissociation, *i. e.*, dissociation under the action of the ions of water.
2. Formation of colloidal films about the particles that act as osmotic membranes permeable to the ions of electrolytes.
3. Absorption of basic ions by the hydrogels, resulting in coagulation.
4. Recombination of dissociated molecules, tending to chemical equilibrium.

After some experiments and much study of the problem of waterproofing concrete, it was believed that if the decomposition reactions could be made to go further, that is, with more reactivity in the mass, the hardened mortar would not only be rendered impervious, but, owing to the greater density, would have increased strength. The experiments of A. L. Cushman on the decomposition of feldspars gave a valuable clue here. He found that treatment of powdered feldspars with dilute solutions of various salts (electrolytes) leads to an increased amount of decomposition products passing into solution. He obtained the same quantity of soluble decomposition products from a finely ground feldspar by treatment with a dilute solution of ammonium chloride as could be extracted by electrolysis, without subsequent regrinding. He concluded that the effect produced by dilute solutions of salts was principally to set free the soluble products of hydrolysis absorbed by the colloidal decomposition products, and thus expose fresh surfaces to the solvent.

Substances existing in solution fall into two groups, crystalloids and colloids, the physical and chemical behavior of which are characteristically different. Crystalloidal substances easily assume the crystalline condition, forming porous masses. The colloids are incapable of crystallizing, thus proving that the two classes of bodies are wholly different in molecular structure.

Many colloidal solutions are able to coagulate either on the addition of foreign substances or spontaneously.

The properties of substances which assume the colloidal state are in part due to the approach of each particle to its molecular state, with a resulting proportional increase of active surface. If we imagine certain inorganic substances divided under water into smaller and smaller particles until this dust is able by virtue of its minuteness to remain suspended in the liquid an indefinite length of time, then we have a colloidal solution. Such a solution represents a suspension of fine particles electrically charged from giving off ions, just as are electrodes. If, now, the suspended particles become steadily smaller and smaller, while at the same time their electric charge grows, they approximate more and more the behavior of ions, until finally the colloid passes over into the crystalloid, which dissociates in aqueous solution into its strongly charged ions.

Not only can electrolytes cause the precipitation of colloids, but one colloid can also cause the precipitation of another.

The colloids are an excellent means, under certain circumstances, of keeping slightly soluble salts in solution, in that they themselves unite with salt ions and form molecular aggregates without necessarily being precipitated. In the setting of cement this is a most useful function of colloids. By this means the precipitation of the scarcely soluble salts is retarded or suppressed, so that the action can take place in the time desired and with a gradual evolution of heat.

The hardening of cement is probably not so much a chemical as a physical process, and may not be due to the formation of chemical compounds at all, but to a specific interaction of colloids and electrolytes which protects the calcium compounds from quick hydration, with consequent sudden increase in volume due to rise in temperature. The deduction follows that without a properly balanced mixture of colloids and electrolytes in the mass, a theoretically perfect cement in strength and permeability would be impossible.

These studies suggested a series of permeability and strength tests on cement mortars with additions of different quantities of a suitable electrolyte and some form of colloidal matter. The electrolyte chosen was ordinary alum, dilute solutions of which were used to replace the mixing water (two and one-half per cent and five per cent solutions). The form of colloid selected was that contained in specimens of finely ground clay. Many clays contain a large amount of substances that assume the colloidal state on the addition of water, which sets free gelatinous decomposition products by hydrolysis. The results of these substitutions showed that not only was a water-tight product secured, but, for cement set in periods of from seven to ninety days, greatly increased strengths were obtained.

The importance of this communication to the literature of civil engineering is not to be lightly regarded. One of the characteristics of concrete construction which has given civil engineers a great deal of concern has been the susceptibility of concrete structures to the impregnating and percolating effects of moisture. Where iron and steel structures are embedded in concrete, engineers, for the most part, depend upon the chemically protective rather than the physically protective action of the cement. When iron or steel rusts it increases in volume, and when it is embedded in cement, the result is almost invariably similar to the effect of freezing

water, which rends asunder even massive pieces of concrete structure.

Many attempts have been made to overcome the percolation of water through cement and concrete structures. While experiments have been made to introduce pigments into the intimate mixture of the cement, the most extensive efforts have been along lines of using surface coverings which would keep the moisture from reaching the susceptible cement structure. This is costly, and even asphalt and bitumen waterproof coverings have a life limit which is far too short to relieve the apprehension of the engineer. The methods of introducing pigments into the constituents of the cement have, in most cases, simply resulted in the formation of isolated particles of impermeable matter which rendered the concrete of lower specific strength; and where success has been partially attained, the cost of the process has been enormous. Mr. Gaines gives to the cement manufacturer what appears to be a radical solution of the difficulty; and at the same time, if the process will stand the test of the experimentation to which the civil engineer will surely subject it, the cement manufacturer can produce a cement which will not only be waterproof, but which will be lower in price because of the cheapness of the clay in comparison with the cost of the calcium compounds which it replaces.

Reorganized Extension Courses in Mechanical Engineering at the Polytechnic Institute of Brooklyn.

The Polytechnic Institute of Brooklyn, starting this year with the reorganized department of mechanical engineering in charge of Professor William D. Ennis, is offering enlarged courses of extension work through its evening classes. These classes began with purely lecture courses about three years ago, and have developed into valuable adjuncts to the regular college work. They offer to the student employed during the day, opportunities for study or review of elementary and advanced mathematics, besides practical courses on engineering subjects.

During the past summer, the mechanical laboratories of the institute have been greatly enlarged and large expenditures made for new equipment, which now includes two steam engines with high pressure boiler, one gas engine, one gasolene engine, one 100,000 pounds testing machine, one small testing machine, pumps, meters, etc., besides the usual small equipment for field and laboratory testing. Laboratory courses are offered to evening students, involving the use of portions of this apparatus, and the training of the student in the precise measurements of engineering. A thorough course in machine design is also to be given under the direction of Professor F. De R. Furman; this will be open to men who have completed the equivalent of one year's work in mechanical drawing, and is intended to fit such men for positions as detail draftsmen. This course in common with others offered will be practical in its nature rather than mathematical. It is given on Fridays at 7.30 P. M.

The courses in heating and ventilating by Professor Taggart, given on the same day and hour, are planned to train men in the practical design of the commercial forms of direct and indirect heating systems.

On Wednesdays at 7.30 P. M. there is to be given a thorough course in mill engineering by Professor Ennis. This will cover the problems met with in the arrangement of buildings, tracks and yards for large industrial works and especial discussion of the various elements entering into their engineering equipment. Attention is to be given particularly to the practical design of such features as crane installations, automatic sprinkler equipment, apparatus for generating and utilizing compressed air and hydraulic operative machines. The general principles covering the economical design of mill buildings will be discussed and exemplified, and the broad relations of engineering equipment to factory organization will be analyzed.

The major course of the series will be that on power plant design given by Professor Ennis, on Thursday evenings. This will start with a consideration of the power-house as a manufacturing plant, its location with regard to the raw material and the market, the choice of site and standard types of buildings. The various items of equipment will then be discussed, their performance analyzed and their relations to the general problems of design investigated. The object of the course is to fit engineers for actual practice in the design and construction of steam or gas power generating plants. The mathematical knowledge required for admission is elementary only, subject being one that permits of thorough treatment without an extended use of higher algebra or calculus.

The evening work at the Polytechnic Institute is largely pursued by men who are candidates for a degree. A certain amount of credit is allowed, based upon the courses taken during the evening, and the student has the encouragement of working toward the same definite end as the usual day student.

The Deformation of the Tantalum Filament When Used with Alternating Current.

The deformation found to take place in the tantalum filament when operated on alternating currents is well known, the result being apparently the breaking up of the filament into short disjointed lengths. An explanation of this effect is offered by F. Stroude, in the *Electrical Engineer,* London, for September 20, this being based upon certain observations reported by Edison when he was working with metallic filaments. A filament made from drawn platinum-iridium wire was constructed and equipped with an automatic switch which would pass a current through it sufficient to fuse it, but before the filament had reached a dangerous temperature, its expansion opened the circuit. As it cooled, the circuit was again closed, and this process repeated. The filament was thus exposed to very rapid alternations of temperature, and upon examination it was found that it was transformed in a manner similar to that which occurs with the tantalum lamp with alternating current. Edison explained the effect by attributing it to the explosive escape of the gas occluded during the drawing process, and to test this thoroughly he tried drawing wires of other metals, and in every case found the same effect. He then tried to remedy this by heating the filament gradually, bringing it up to a red heat for ten minutes, switching it off and on, as to allow it to be cooled alternately. Then a larger current was passed through for ten minutes more and the process repeated until the current had been carried to the high value desired. The object of this was to allow the gases to escape gradually. The cooling was to allow the filament to contract and weld together. It was found that this treatment considerably increased the life as compared with an untreated filament and made it possible to operate it at a higher temperature. The deformation no longer took place. This treated filament had a smaller diameter than the original, and could be annealed. This theory, it is thought, will also account for the blackening of the bulb of the tantalum lamp, this being due to the metallic tantalum thrown off from the filament by the escaping gases. If the theory suggested be true, a method of treatment which will enable metallic lamps to be operated on alternating currents is available.

THE COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION.

DENVER, COL.

The fifth annual convention of the Colorado Electric Light, Power and Railway Association convened at the Savoy Hotel, Denver, Col., on Wednesday morning, September 18, at 10 o'clock A. M. Owing to a delay in securing this transcript of the proceedings, a full report has been unavailable until this time, although a summary of the proceedings was published in the issue of the ELECTRICAL REVIEW of September 28. The first part of the morning session was occupied by the registering of members, which registration showed the following active and associate companies represented by one or more delegates:

ACTIVE MEMBERS.

The Central Colorado Power Company, Colorado Springs, Col.; the Green River Electric Light and Power Company, Green River, Wyo.; the Denver Gas and Electric Company, Denver, Col.; the Pikes Peak Hydro-Electric Company, Manitou, Col.; the Leadville Light and Power Company, Leadville, Col.; the Buena Vista Electric Light and Power Company, Buena Vista, Col.; the Colorado Light and Power Company, Cripple Creek, Col.; the Denver City Tramway Company, Denver, Col.; the Colorado Springs Electric Company, Colorado Springs, Col.; the Arkansas Valley Electric Company, Florence, Col.; the Gilpin County Light, Heat and Power Company, Central City, Col.; the La Junta Electric Company, La Junta, Col.; the Larimer Light and Power Company, Fort Collins, Col.; the Greeley Power and Light Company, Greeley, Col.; the Albuquerque Gas, Electric Light and Power Company, Albuquerque, New Mex.; the Tucson Gas, Electric Light and Power Company, Tucson, Ariz.; the Montrose Electric Light and Power Company, Montrose, Col.; the Sheridan Electric Light and Power Company, Sheridan, Wyo.; the Rawlins Electric Light and Power Company, Rawlins, Wyo.; the Pueblo & Suburban Traction and Light Company, Victor, Col.; the Golden Illuminating Company, Golden, Col.; the United Hydro-Electric Company, Georgetown, Col.; the Boulder Electric Light and Power Company, Boulder, Col.; the Las Animas Electric Company, Las Animas, Col.; the Trinidad Light and Power Company, Trinidad, Col.; the Pueblo & Suburban Traction and Light Company, Pueblo, Col.

ASSOCIATE MEMBERS.

The Ohio Brass Company, Mansfield, Ohio—Frank E. Johnson, Denver, Col.; E. C. Brown, St. Louis, Mo.

The Onderdonk Engineering Company, Denver, Col.—H. R. Weber, Denver, Col.

The National Electric Lamp Association, Cleveland, Ohio—J. C. Fish, George Loring.

The Westinghouse Electric and Manufacturing Company—E. C. Means, B. S. Manual, L. M. Cargo, Denver, Col.; Charles Robbins, Pittsburg, Pa.

The Nernst Lamp Company—R. D. Marthens, C. M. Wright, Denver, Col.

The Hendrie & Bolthoff Manufacturing Company—D. V. Sickman, J. C. Davidson, Denver, Col.

The Continental Oil Company—H. A. Squibb, W. H. Squibb, Denver, Col.

The Allis-Chalmers Company—D. H. Rich, Denver, Col.

The Stearns Rogers Manufacturing Company—A. B. Kennedy, Denver, Col.

The American Steel and Wire Company—G. J. Williams, Denver, Col.

The General Electric Company—F. W. Willcox, Harrison, N. J.; Irving Hale, Denver, Col.

The Westinghouse Machine Company—C. C. Chappelle, Chicago, Ill.; A. A. Rogers, Denver, Col.

The Wagner Electric Manufacturing Company—Thomas T. Richards, St. Louis, Mo.

J. A. Roebling's Sons Company—J. McG. King, Denver, Col.; A. B. Conover, Chicago, Ill.

The Mountain Electric Company—J. W. Stearns, Denver, Col.

The New York Insulated Wire Company—B. K. Sweeney, Denver, Col.

The Central Electric Company—J. A. Savage, Denver, Col.

The American Circular Loom Company—George C. Richards, Denver, Col.

The Western Electric Company—M. H. Nichols, Denver, Col.; W. J. Laufenberg, St. Louis, Mo.

The meeting was called to order by George B. Tripp, president, at 11 A. M., and after the roll call by J. F. Dostal, secretary, Mr. Tripp delivered his address.

The first paper presented before the convention was by B. E. Buttles, of Denver, on "Notes on Modern Boilers," the principal point brought out in the discussion being as to which type of boiler, the return tubular or water tube, had been found most satisfactory by the smaller central stations; according to the experience of most of the companies represented it appeared that the water-tube boiler undoubtedly gave the best service, although tests made on the water-tube boiler showed that the tubes filled with scale and required blowing quite frequently. The opinion was that if enough of the water-tube boilers were installed so as to give sufficient capacity when one of the boilers was out of commission, this type was undoubtedly the better of the two mentioned.

Charles Robbins, of the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa., then presented a paper on "Central Station Power Problems," after which a very interesting discussion was had.

The question as to what inducements were offered to power consumers using current for the twenty-four hours in order to keep them off the peak load, was answered by one company, stating that a special rate was given to such a consumer and others reserved the right to shut off the current during the peak of the load, giving no special rate, the latter, however, never having taken advantage of this privilege.

The advisability of dividing a city into three districts, day, maximum and night and having the commercial representatives work along these lines was suggested in Mr. Robbins' paper and was considered a good suggestion.

In order that buildings now being erected might be wired correctly and the lights placed in the proper positions, the matter of conferring with architects in charge of the various buildings was cited as a most successful plan in order to obtain the best results, one of the companies stating that this had been their policy and through their endeavors along this line they had been able to interest the owner and architect in the proper wiring of buildings and with the assistance of an illuminating engineer had been able to secure a great deal of business which otherwise would not have been obtained.

The matter of installing small units was discussed in a very thorough manner, most of the companies being of the belief that the installation of electric irons especially had proven a very profitable step, many of the companies having first put the irons out on trial and, in the majority of cases where the iron had been given a fair trial the company had been able to place the iron, some companies selling for cash and others on the instalment basis, the revenue received from each iron installed averaging from fifty cents to $1.00 per month.

G. E. Putnam, of Denver then read a paper on "Business Building by Commercial Departments."

One of the points brought out in this discussion was a scheme, which had originated with the Denver company, of sending out service supervisors, who were given a list consisting of the names of about three hundred old consumers, restricting them in their work and not allowing them to solicit business from new consumers, the results showing an increase of about forty-four per cent on gas and thirty-nine per cent on electric. The expense to the company in securing this business was very small, there being practically no construction costs, the only expense being the salary of the service supervisors, who are paid a fixed salary plus a certain per cent of the increase from the consumers on the list referred to.

The question of furnishing free signs to consumers was spoken of, but according to the experience of many of the members it was not considered a paying proposition. One suggestion regarding the installing of signs was given being that inasmuch as at the present time a consumer usually wanted a sign suitable for his particular business the best method was to have him order his own sign and the company do the construction work, provided a contract was entered into for at least two years time; if the contract was canceled the consumer would be called

upon to pay for the construction charges, otherwise the company would pay for them. This same idea was carried out in regard to window and display lighting.

It was stated by some of the members that during the past summer the companies had rented out electric fans at $1.00 per month and in this way had been able to put out a great many fans.

On Thursday evening F. W. Willcox, of the General Electric Company, presented a paper on "The Incandescent Lamp Outlook," the most important point in the discussion of this paper being the substitution of the tungsten high-efficiency lamp for the gasolene lamps now being used in many of the smaller towns. Up to the present time a substitute for these gasolene lamps had not been found and it was thought by many that this tungsten lamp would probably be the proper one to introduce in this connection. It was stated that at the present time the manufacturers of this high-efficiency lamp would only be able to get out a limited number, and on account of this it was the consensus of opinion that the larger unit, or the 100-watt lamp, was the most desirable one, as users of gasolene lamps demanded something which would furnish as good a light as that furnished by the gasolene lamp now used.

The free renewal of lamps was also a subject thoroughly discussed. Some of the central stations did not furnish free lamp renewals, while others did, but as a general rule the larger companies all furnish free renewals and considered it very good policy. Regarding the free renewal of the high-efficiency lamp, Mr. Willcox stated that companies furnishing free renewals at the present could afford to do so with the high-efficiency lamps also.

The next subject brought to the attention of the convention was the subject of "Lighting Protection in Colorado," by Leonard Wilson, of the Denver office of the General Electric Company. Mr. Wilson gave a very interesting talk on this subject, describing the various types of arresters used at the present time, both in eastern cities and in Colorado where, due to the large number of disturbances, the matter of lightning protection was a very important one. He then gave his experience in regard to the use of the multi-gap, liquid electrode and aluminum, and the various conditions under which each of these arresters gave the best service, some being better adapted for some localities than others, the multi-gap furnishing very good protection in the case of line oscillations, but for high frequency and high energy lightning discharges this type does not give good satisfaction, the liquid electrode and the aluminum being best adapted for all kinds of lightning discharges.

As a general rule the lightning disturbances in the state of Colorado have caused a great deal of trouble, but during the past summer the number of electrical storms have been very few in comparison with other years and the shut-downs on this account have been very light in most all sections of the state. The multi-gap arrester seemed to be the one used mostly, but the liquid electrode and aluminum were also used in some districts.

The matter of protection for low-voltage circuits seemed to be a serious question, inasmuch as the losses on these circuits are usually very large and up to date no arrester had been found which would give full protection on these particular circuits. From Mr. Wilson's remarks it would seem that the aluminum cell arrester would furnish the protection required for these circuits.

The last paper brought to the attention of the convention was presented by Frank E. Johnson, of Denver, on "High-Tension Porcelain Insulators."

Due to the limited amount of time the discussion on this paper was very short, the principal point being in regard to the suspended type of insulators, G. R. Hall giving a description of the "fish-tail" insulator, being of the suspended type, and now manufactured by the General Electric and Westinghouse Electric companies, to stand a break-down test of 50,000 volts. The matter of the inspection of insulators was spoken of, some of the companies stating that a daily inspection seemed the proper thing, while others stated that weekly inspections were all that were necessary.

By an amendment to the constitution, companies operating in the states of Montana, North and South Dakota may become members of the association.

George Loring, of the National Electric Lamp Association, then gave a short talk on the object of the National Electric Lamp Association, the relations of the various companies one to another and a statement regarding the work of the association.

Reports of the various committees showed that the association was in better condition, both financially and otherwise that it had ever been before in its history, and that the future outlook for the association was to say the least very bright.

The following were then elected to office for the ensuing year:

W. G. Matthews, president, Denver City Tramway Company; C. K. Durbin, vice-president, United States Lighting and Traction Company; J. F. Dostal, secretary and treasurer, the Denver Gas and Electric Company.

Executive Committee—W. G. Matthews, the Denver City Tramway Company; C. K. Durbin, the United States Lighting and Traction Company; J. F. Dostal, the Denver Gas and Electric Company; G. B. Tripp, the Central Colorado Power Company, Colorado Springs, Col.; W. T. Wallace, the Colorado Light and Power Company, Canon City, Col.

Advisory Committee—J. A. Beeler, the Denver City Tramway Company, Denver; W. J. Barker, the Denver Gas and Electric Company, Denver; J. F. Vaile, the Pueblo and Suburban Lighting and Power Company, Pueblo, Col.; Irving Hale, the General Electric Company, Denver; J. J. Cooper, the Mountain Electric Company, Denver.

Membership Committee—L. M. Cargo, the Westinghouse Electric and Manufacturing Company, Denver; E. P. Dillon, the Pikes Peak Hydro-Electric Company, Colorado Springs, Col.; B. K. Sweeney.

Finance Committee—D. V. Sickman, Hendrie & Bolthoff Manufacturing Company, Denver; W. E. Robertson, Leadville Light and Power Company, Leadville, Col.; G. H. Maxam, Green River Electric Light and Power Company, Green River, Wyo.

Final adjournment.

An Edison Engineering Commission.

An Edison engineering commission has been appointed by the executives of the Edison illuminating companies of New York, Chicago, Boston, Philadelphia and Brooklyn, to make a thorough investigation and to report with recommendations on the design, construction and operation of the generating, transmission and distribution systems of each of the five companies. This commission is composed of three engineers from each company, and is organized as follows: W. F. Wells, of Brooklyn, chairman; P. Junkersfeld, of Chicago, secretary; W. C. L. Eglin, of Philadelphia, treasurer; L. L. Elden, of Boston, chairman committee on operation; P. Torchio, of New York, chairman committee on design, and W. C. L. Eglin, of Philadelphia, chairman committee on purchased apparatus.

Report on Economy Tests of a 7,500-Kilowatt Westinghouse-Parsons Steam Turbine.

The following data comprise the principal results obtained on September 1, 1907, during an eight-hour economy test upon turbine No. 253, installed earlier in the year, at Waterside Station No. 2, of the New York Edison Company. This test was conducted entirely by the New York Edison Company, under the direction of J. P. Sparrow, chief engineer. The various arrangements therefor were carried out in accordance with a mutual agreement between builder and operator, entered into previous to the test, and the results, as herein given, were obtained by independent computation.

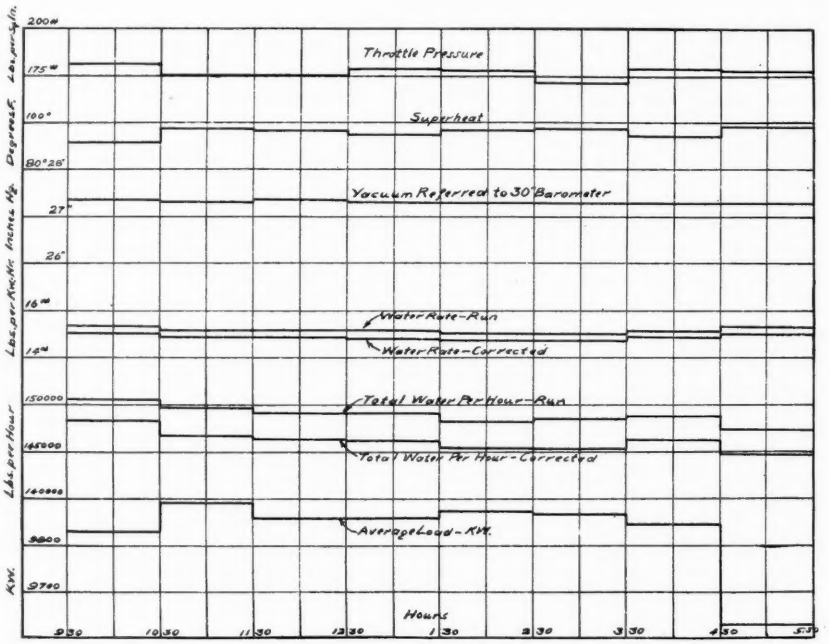
The turbine unit tested is of standard Westinghouse construction throughout. It has a maximum rated capacity of 11,250 kilowatts, and was built to operate on 175 pounds steam pressure, twenty-eight inches vacuum, and 100 degrees superheat. Under these conditions, the turbine unit was guaranteed to have a minimum steam consumption of 15.9 pounds per kilowatt-hour at the generator terminals, with a normal speed of 750 revolutions per minute. Incidentally, the electrical efficiency of the generator was guaranteed to be 97.8 per cent, exclusive of friction and windage, at a load corresponding to that sustained during the test. The results of the test detailed below show an economy about 7.5 per cent better than the guarantee.

METHODS OF CONDUCTING THE TEST.

Load—During the test period, No. 2 Waterside Station sustained practically all of the twenty-five-cycle load on the system, of which the unit under test carried practically seventy per cent, the remainder by the other turbine units in the station. This load was maintained as constant as possible by remote control of the turbine governor by the switchboard operator. Between the first and the last hours of the test the maximum variation in load was held within four per cent above and below mean. During the last hour, however, the load decreased somewhat. Previous to the test, this turbine unit had been running on a load of 7,000 kilowatts, which was increased to its test load ten minutes before the start.

Calibration—Three-phase electrical load was measured by the two-wattmeter method, using two Weston indicating wattmeters of the standard laboratory type. These instruments were calibrated at the New York Electrical Testing Laboratories immediately before and after the test. Power-factor was maintained substantially at unity, and all electrical readings were taken at one-minute intervals.

Steam Consumption—As a surface condenser was used in connection with this turbine unit, the water rate was determined by weighing the condensed steam delivered from the condenser hot-well. This condensation was weighed in a tank mounted upon platform scales, with a reservoir above large enough to hold the condensation accumulating between each weighing. These weighings, of 12,000 to 13,000 pounds each, were made at intervals of five minutes.



HOURLY LOG—NEW YORK EDISON ECONOMY TEST. 7,500-KILOWATT WESTINGHOUSE-PARSONS TURBINE, SEPTEMBER 1, 1907.

Gland Leakage—By the loop method of connecting the gland water supply the necessity for correcting condensation by an amount equivalent to the weight of the gland water used, is avoided. A continuous gland-water circuit is used entirely outside of the weighing apparatus, and all overflow from the standpipe returns to the hot-well delivery.

Condenser Leakage—As the circulating water is quite salt, any condenser leakage may immediately be detected by the salinity of the condensed steam, which should be pure distilled water. On this account, condenser leakage was determined entirely by chemical analysis, employing the silver-nitrate test with a suitable color indicator. This method proved extremely sensitive, and possessed a decided advantage over the ordinary method of weighing the leakage accumulating during a definite period when the condenser is idle and under full vacuum. As samples of circulating water and condensed steam could be taken at the same time, this method made it possible to discover any change in the rate of condenser leakage taking place during the test, while the method of weighing above described provides only an average result during the period.

Hot-Well Correction—In this condensing plant, the delivery of the hot-well pump is automatically controlled by a float valve in the interior of the hot-well. This maintains the water level therein at a practically constant point, and hence no correction had to be made for difference in level of water in the hot-well before and after the test.

Steam Supply—Steam pressures and temperatures were determined close to the turbine throttle. As usual, the degree of superheat was obtained by subtracting from the actual steam temperature the temperature of saturated steam at the corresponding pressure carried at the time. All gauges and thermometers were calibrated previous to the test at the United States Testing Bureau. It will be noted that both pressure and superheat were somewhat below the guarantee.

Vacuum—Vacuum was measured directly at the turbine exhaust by means of a mercury column with a barometer alongside for reducing to standard barometer—thirty inches. This also obviated the necessity for temperature correction between the two mercury columns. During the test

the vacuum was not maintained quite up to normal.

RESULTS OF TESTS.

The following data represents the results of the tests, calculated for the conditions, as actually run; *i. e.*, for instrumental errors only:

Duration of test, 9.30 A. M. to 5.30 P. M.	
Average steam pressure at throttle, pounds per square inch gauge....	177.5
Average superheat at throttle, degrees Fahrenheit.....	95.74
Average vacuum (referred to 30-inch barom.) in. Hg.....	27.31
Average load on generator, kilowatts	9,830.48
Average steam consumption, as tested, pounds per kilowatt-hour..	15.15

Test Correction—Owing to the departure, during the test, from specific operating conditions upon which guarantees were based, it was necessary to correct the observed results by following amounts:

Pressure (2.5 pounds high) correction	0.25 per cent
Vacuum (0.69 inch low) correction	1.84 per cent
Superheat (4.26 degrees low) correction	0.29 per cent

These corrections were mutually agreed upon previous to the test as representative of this type of turbine. When applied to the observed steam consumption given above, the following results, representing contract conditions, are obtained:

Average corrected water rate during eight-hour test, 14.85 pounds per kilowatt-hour.
Guaranteed water rate, 15.9 pounds per kilowatt-hour.

Log—Referring now to the accompanying log, it is interesting as a check upon the average figures above presented, to observe the results segregated into hourly periods, as shown. Here it will be noted that the load was considerably lower during the first and last hour than during the main part of the test. Neglecting, therefore, these two hours and considering only the six-hour period from 10.30 A. M. to 4.30 P. M., the results are as follows:

Average corrected water rate, 14.8 pounds per kilowatt-hour.
Equivalent water rate, 10.65 pounds per brake-horse-power-hour.
Equivalent water rate, 9.8 pounds per indicated-horse-power-hour.

The two latter quantities are determined by applying conversion factors for generator efficiency and for internal losses.

In connection with these tests, a noteworthy agreement exists between the results noted and those previously obtained from tests of machines of similar design installed in the Manhattan station of the Interborough Rapid Transit Company, of New York, and the Long Island City station of the Pennsylvania Railroad. At the same loads and with equivalent operating conditions, the performance of the machines is almost identical. These economic results, while not exceeding in actual steam consumption the best records of European practice, yet are extremely good in view of the moderate operating conditions under which the test was conducted. In fact, they represent the best results that have yet been obtained by turbine under the conditions named.

Electrical Haulage in Mines.

The increasing adoption of electricity for mining purposes in Europe and America, and the satisfactory and economical results with which its adoption is attended, must, says the *Electrical Engineer*, eventually effect its use in England, despite the conservatism of mine managers. The fact that a country like Belgium, for instance, whose output of coal is but small in comparison to that of the United Kingdom, and the physical features of whose coal zones are peculiarly difficult for the work of producing coal, should go in largely for improved electrical apparatus is a testimony to the superiority and economy of that class of apparatus in the work of coal production, especially when it is remembered that the neighboring coal-fields of Germany (and, in a lesser degree, those of the United Kingdom) lie very close, and that as there is no fiscal barrier to obstruct the free entry of coal into the country, the price of that commodity must be kept at the cheapest possible level. Sir C. Hertslet, in a report to the British Foreign Office on the coal-mining industry of Belgium, writes that "some of the mines of the country have adopted electricity as the sole motive force for extraction, pumping and ventilation, and what are regarded as satisfactory and economical results have been obtained." The question of electric *versus* steam engines is one which has been much discussed in technical circles, and although it is likely to remain in an indefinite state for some time to come, there can be no doubt as to the superiority of the electrically driven machine where local conditions are favorable. It is of interest to follow Sir C. Hertslet's remarks, which, on the whole, are favorable to electric machinery, and bring to light the greater simplicity of its manipulation. He cites the following instance: "One of the events most liable to cause accidents in mines is the possibility of the machinist failing to stop the cage at the exact moment. This is met in a certain measure by the provisions which compel mine owners to have a second machinist when shifts of workmen are going up or down the shaft, but a momentary aberration or indisposition of the machinist at a critical moment might be the cause of a terrible accident before the second man could stop the machinery. In working steam engines the attention of the operator is divided between several control levers, whereas one of the greatest advantages of the electrical machine in this connection is that only one main controlling lever is required. In addition, on the one electric machine which I have seen at work in Belgium, a safety contrivance was attached which, in the event of the machinist omitting to stop the cage on its upward or downward course, automatically brings the starting lever to the zero position and stops the cage." In the report there is given a copy of the most recent law respecting the lighting of mines and of the lamps authorized to be used for this purpose. Among the latter may be mentioned the Wolf lamp, used in the mines of the Mariemont & Bascoup Company, which is one of the largest and best-administered mining companies in Belgium. This is a benzine lamp fitted with an automatic relighter, and, in addition, possesses the advantage of automatically looking after it has been filled and screwed together, so that it is impossible for the workers in the mines to open it, as this can only be done by means of an electromagnet specially used for the purpose. Belgian experience shows no insuperable difficulty in the use of electricity in mining, the advantages of which only need to be persistently urged to receive the recognition of mine managers. With the attention that is now being given by electrical engineers to perfecting machinery, the future should see an undeniable extension of the application of electricity to mining in this country as well as in others.

A New Electrical Association in Marion, Ohio.

The Marion Electric Association was organized on the evening of Tuesday, September 24, by the Ohio Novelty, Sign and Electric Company, the Marion Electric Supply Company and the Marion Railway, Light and Power Company. The association is for the purpose of promoting the growth of electrical industries in the city and the holding of an exhibit of electrical appliances some time in November. The officers elected are D. J. Sheldon, president; Frank Glosser, secretary, and W. G. Lucas, treasurer.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

Note on the Magnetic Field Due to Electric Current in a Straight Line.

The force in dynes on a unit of magnetic pole outside an infinitely long straight wire carrying a current is, as is well-known, tangent to a circle through whose centre the wire passes at right angles, and this force is numerically equal to twice the value of the current in absolute units divided by the distance from the axis of the wire in centimetres. Although the approximate direction of this force is easily found experimentally, its numerical value is only determined by integrating the effects of all parts of the current, and since the force is in a plane at right angles to the wire, it is not always easy to make clear to students beginning the subject why it is necessary to consider parts of the wire off this plane. This, says W. J. Humphreys, is one of the many places where the electron theory can be used to marked advantage, and besides, if, as many believe, it is the correct theory, or embraces a larger number of facts than any other, then it should be used both in this case and in all others. Let electrons, all moving in the same direction with a constant velocity, be uniformly distributed along a straight wire. Then, assuming the field of force from each electron to be the same in all directions, that is, moving slowly and undisturbed by other electrons, the rate of change of induction, due to the electricity at all parts of the wire, through a circle at right angles to it, is obtained by integrating the rate of change of flux at a point due to an element of this wire performing this integration and gives, of course, the equation given above. The solution, however, may be made in a simpler way. Presume the field due to each electron is influenced by all others, and so influenced that it is confined to a plane at right angles to the wire but equal in every direction from it. From this it follows at once that the rate of change of flux is equal to $4\pi C$, C being the current or the total number of electrons passing a point in one second. It follows from this since the rate of change of flux or potential is equal to the work done in making one revolution around the wire that the force at any point is equal to $\frac{2C}{a}$, being the distance from the wire. According to this conception, which the author holds to be the correct one, the magnetic force at any point is due entirely to that part of the current nearest to this point, the more distant points having no direct effect whatever. But, of course, as just explained, all electrons produce their full effect indirectly by compressing each other's fields into planes at right angles to the wire.—*Abstracted from Science (New York), September 27.*

Electric Traction on Railways.

In this section of a series of articles, Philip Dawson discusses running curves of motors and shows how these curves, when obtained for a single-gear ratio, may be converted to other ratios, and also how the most suitable gear ratio may be determined when a running curve is given. The tractive effort multiplied by speed is a constant for any given current, hence to change from one gear ratio to another, it is only necessary, for each current value, to change the tractive effort in the inverse ratio of the two gear ratios. This method of transformation is only applicable to given conditions. For if the grades and running distances and number of stops be changed, the only way of ascertaining the best gear ratio is by means of trial and error, and complete calculations, and have to be made in the entire run before it will be possible to ascertain what would be the best gear ratio to adopt for any individual case. In making such calculations and in preparing the numerous running curves, it should be borne in mind that a certain reserve must be held back so as to make up for lost time, as in practice such reserve proves to be of the utmost importance. Given the curve of kilowatt consumption for a certain run, it is possible from this to plot a curve showing the load of the motors in amperes throughout the day. This curve makes it possible to obtain the mean effective current to which a motor will be subjected, and to see whether the motor under consideration is of such design as to be fit for the service for which it is proposed. The usual and laborious method of obtaining this mean effective current would be to subdivide the area included in the current curves into small rectangles so as to integrate it, but a simpler way can be found by using polar coordinates. To change from rectangles to polar coordinates, a scale for the polar slot may be chosen at will, for example, ten degrees equal one minute of time. The next point is to find the radius at which one metre of time in the polar plot is the length of one centimetre, or the same scale as the rectangular plot. With the unit of ten degrees chosen above, the entire circumference of the polar circle will represent thirty-six minutes, and the radius of a circle whose circumference is thirty-six centimetres is 5.73. This constant, 5.73, is an important link between the two parts. Using these units, the values of the rectangular curve are taken from the polar curve. The author shows that by measuring the area of the figure thus obtained a value is found which, if multiplied by a constant determined by the scale employed, will give a value equal to the sum of the squares of the different current values. He then applies this method to a concrete example to show how it enables the best gear ratio to be selected for any particular service.—*Abstracted from the Electrician (London), September 20.*

Concerning Insulating Varnishes.

In this discussion of insulating varnishes, A. R. Warnes confines himself largely to a condemnation of linseed oil for such use. He introduces his remarks by saying that too frequently chemical advice is not sought in the preparation of such varnishes. The materials used to dissolve these varnishes frequently are compounds of organic acids or contain such acids, and in the end their action is to corrode the metal with which they come in contact, and gradually to destroy the insulation. Varnishes usually harden by virtue of chemical changes, sometimes assisted by the oxygen of the atmosphere. These changes progress slowly, and as the machines are invariably tested shortly after being varnished, the end of the chemical reaction has not been reached, and, therefore, the test obtained is misleading. The result of these chemical

changes is practically without exception a lowering of the disruptive and ohmic insulation resistance or a disintegration due to brittleness. The latter fault is the most frequent in occurrence. One of the principal ingredients used in the manufacture of insulating varnishes is linseed oil; some varnishes contain very little else. Yet, for this purpose linseed oil is one of the worst materials to use. It holds its position in the paint and varnish trade on account of its property of rapidly absorbing oxygen, especially after it has been boiled, but the absorption of oxygen does not stop after hardening, as it will continue until a viscid substance, soluble in water to a considerable extent, is formed. Under the conditions obtained in electrical machines the oxidation of the oil does not get this far. The oil film becomes broken and cracked long before the final stage of process is reached. If machines on which such varnishes have been used do not break down from other causes, they certainly will when the condition just mentioned is reached. Since the oxidation of the oil takes place rapidly, the film becomes hard and tough, after which the oxidation is slow. As day by day aging proceeds, the ability to absorb moisture increases. Figures are shown by the author, which seem to indicate that the percentage of moisture absorbed is proportional to the amount of linseed oil used in the varnish. This was tested by painting pieces of tin with different varnishes, drying them thoroughly, then weighing them, and exposing them to the air for a number of weeks, after which they were again weighed and dried. In every case, after the second drying, the original weight was found, but those varnishes containing the most linseed oil were found to have absorbed the greatest amount of moisture at the second weighing. Similar tests were conducted with samples of linen coated with different varnishes, the results being in agreement with the previous tests. It is well-known that low ohmic insulation resistance is conjoint with damp insulation, and this undesirable state is aggravated by the use of varnishes containing linseed oil. The low ohmic resistance found in electrical apparatus, after standing idle for some time, is due to the absorption of moisture caused mainly by the deterioration of the varnish. Linseed oil varnishes can not be considered waterproof, for although there may be an unbroken film of varnish, the varnish itself will take up moisture and allow it to be absorbed by the insulating material which it is supposed to protect. Another disadvantage of linseed oil varnishes is the shrinkage which occurs with age. For this reason varnished coils, which at first fit snugly in their bobbins or slots, as they age may become slightly loose, due to shrinkage, and thus allow sufficient motion to abrade the insulation. The author also objects to the use of rosin in preparing insulating varnishes, since this material is formed largely of organic acids, and thus corrodes any material upon which it is placed.—*Abstracted from the Electrical Review (London), September 20.*

A Study of the Propagation and Interception of Energy in Wireless Telegraphy.

The results are given here of a series of investigations made by C. A. Culver for the object of determining the relative efficiency of several different types of wireless telegraphic receiving systems when used under various conditions. The results of the experiments relate to the conditions at the receiving station only. The work was done on a comparatively small scale, as the radiating system consisted of an insulated wire ten metres in length; 7.8 meters of this was supported in vertical position. The power for sending the messages was supplied by a transformer, operating on a 104-volt, sixty-cycle circuit, the potential developed being about 5,000 volts. The spark-gap was between two steel balls supported on brass tubes, the length of gap being from one to two millimetres. To determine when the receiving station was in tune with the sending station, a special hot wire ammeter was constructed which was placed in series with the antenna, since, in this position, its indications were independent of the frequency. The energy-measuring instrument was an oscillating current galvanometer modeled along the lines suggested by Fleming. This instrument consisted of a small current wound on a hollow hard-rubber bobbin. Directly in front of this a small silver disc was suspended by a fine quartz fibre. The disc also carried a tiny mirror. The two stations were 150 feet apart. The wave length employed was measured by means of an adjustable oil condenser, and a thermogalvanometer. The first experiments were to determine the effects of earth resistance. It was observed that much better transmission was secured if the two antennæ were grounded on gas or steam pipes than when the ground connection consisted of buried wire netting. Various different types of ground were made and in some cases insulated wires were run between the two ground connections. The results of these tests impressed the author of the importance of having a good ground, and lead him to conclude that the principal transmission of wireless messages was through the ground, and to test this he made several other experiments. He also tested the directive action of horizontal antennæ of different lengths, and found that under the conditions of operation existing, the square of the current received was proportional to the length of the antenna. He also tested the directive action of capacity areas, and also the effect of changing the plane of this area with respect to the direction of sending and to the ground. He found that a change of direction around a vertical axis had practically no effect on the transmission, and a change around a horizontal axis affected transmission but a few per cent. By substituting a still larger capacity area, a slight difference in transmission was found when this was turned about a vertical axis. It was found that by using a helix for the collecting system such an arrangement, if open-circuited, collected an equal amount of energy in all positions, but when the circuit was closed, much less energy was received, and apparently this arrangement did not follow the law of the open-circuit coil. Returning to the question of transmission through the air or ground by means of a number of antennæ arranged differently and some shielded, it was found that a single vertical wire was the most efficient of all receiving arrangements, and shielding this wire by means of a metallic tube had little effect on its efficiency, the difference being less than ten per cent. The author concludes from his experiments that since but little effect on the transmission is produced by changes in the receiving system, even when close to the ground, although it has been said that the greater portion of the energy transmitted resides in the lower portion of the wave, and since the earth resistance plays such an important part, that the transmission is mainly by means of electric oscillation set up in the earth, that Hertzian waves are set up above the ground and that these play but a minor part in the transmission. This, he admits, does not explain the difference in transmission noticed during the day and at night, but he believes that it does explain a number of other puzzling results. For instance, the transmission seems to follow the law of inverse distances, and not inverse squares. He thinks that a wireless telegraph system simply sets up alternations of electrical potential in the earth, and the currents resulting from these potentials carry the signals.—*Abstracted from the Physical Review (New York), September.*

Methods of Getting New Business

A DEPARTMENT DEVOTED to the COMMERCIAL DEVELOPMENT of CENTRAL STATIONS

Managers are Invited to Contribute Suggestions for Methods of Increasing the Demand for Electric Service

EDITED BY CHARLES A. PARKER.

Live Commercial Methods in Use in Elgin, Ill.

A little over a year ago the Aurora, Elgin & Chicago Railway Company, connecting Elgin and Aurora with Chicago, and the Elgin, Aurora & Southern Traction Company, an interurban line operating between Elgin and Aurora, consolidated, with Edwin C. Faber, general manager of the Aurora, Elgin & Chicago Railway Company, at the head of the entire system. Mr. Faber was just the man for the place, having a thorough knowledge of the railway and electrical business, possessing unusual executive ability, and being endowed with good hustling American business talent.

Prior to the consolidation, the Elgin lighting plant was owned by the Elgin, Aurora & Southern Traction Company, and was enjoying a fair measure of business, but, unfortunately, a large number of the best patrons were on a flat-rate basis.

One of the first important moves that Mr. Faber made after taking charge of the consolidated properties was to put electric light patrons on the meter rate, and inside of six months, with his broad-minded policy and square dealing, he was able to eliminate nearly all complaints.

On June 11, 1906, during the reorganization of the lighting department, L. B. Judson was put in charge of the new-business department and the advertising end of the business. Mr. Judson is a hustler and firm believer in direct-by-mail and newspaper advertising for increasing the sale of current, and he knows how to select and use the most efficient kind to the very best advantage.

As residence manager, the company employs the services of L. R. Hicks, who is one of the best-posted men in the country, from a technical standpoint.

After consolidation the first thing that was done was to contract with an advertising agency which makes a specialty of central station publicity for an electrical bulletin to be gotten out monthly, and three distinct direct-by-mail advertising services as follows:

One to residents, to lay before the public the paramount advantages and general superiority of electric light, and the practical uses and economy of the numerous electrical devices for the household, especially the electric flat-iron.

One to power users, to show by strong, logical and technical arguments how and why electric power is more economical and better all around for all power purposes.

One to stores and business places, to show merchants and business men exactly why and how electric light is an unusually desirable thing for show-window lighting, interior store illumination, fans, outline lighting and many other commercial purposes.

All of these services consist of well-gotten-up and attractive mailing cards, booklets, folders, etc., and they prove valuable business-getters.

BRIGHTER
BALTIMORE
Are you for it?
Then you're for
Nernst Lamps
for your place of business. They mean twice as much light for the same money. Call us up and let us tell you about them.
BALTIMORE ELECTRIC CO.
Maryland Telephone Building, BALTIMORE, MARYLAND
TELEPHONES: COURTLAND 790. MARYLAND 29

The Baltimore Electric Company, in conjunction with the Nernst Lamp Company, is getting out some advertising emphasizing the slogan of a brighter Baltimore. We reproduce one of the mailing cards which has been used along this line, and also a button, distributed broadcast, which should be an exceedingly effective means of booming electricity in general, and the Nernst lamp in particular, in Baltimore.

Of course, all inquiries from the Aurora, Elgin & Chicago Railway Company's advertising were followed up by solicitation.

The sign part of the company's business is now being pushed, and it has succeeded in installing a large number with prospects for a large volume of business in this direction in the near future.

The display room of the Aurora, Elgin & Chicago Railway Company is one of the best rooms of the kind that has been brought to the writer's attention in many a day. In it are displayed all the electrical utensils that are advertised in the company's bulletins, newspaper advertisements and other different services. On the second floor of the display room is carried a full line of electric fixtures, which are tastefully arranged around the walls and on the ceilings in order to show customers exactly how they will look when installed.

The lighting department of the Aurora, Elgin & Chicago Railway Company has its own contract department and the company works several unique schemes to interest prospective customers. It finds that one of the strongest offers it can put up is to give a flat-iron free to every house wired. The wiring department made the following record from January 1, 1907, to August 1, 1907: fifty residences, 100 stores and offices; twenty-five shops, such as foundries, carpenter, blacksmith's, paint and bakeries; thirty barns.

The company finds that many large barns take more current than most residences, and if it once succeeds in getting a barn wired, it is generally only a question of time before the residence is wired.

Whenever it is possible the barn is wired so that the lights can be turned on and off from the house.

One of the latest plans which this enterprising company has adopted to induce people to have their houses wired is by offering to wire houses under construction for $3 per light opening, and to wire old houses at $3.50 per light opening. This

includes the wiring complete and the following: one two-light electric fixture in the parlor, sitting room and dining room with wall snap switches to turn the current off and on; one one-light electric fixture in the downstairs front hall with switches in the downstairs and upper hall, so that a light can be turned off or on at either place; electric side brackets or drop-light on cords in the kitchen, bedrooms, up-stairs hall and bathroom; elec-

Showing cover and three of the inside pages of a very attractive monthly bulletin issued by the Aurora, Elgin & Chicago Railway Company. It is excellent both in contents and design and is bound to win attention.

tric socket and wall switch for the porch and basement. Glassware for fixtures is charged for extra. Electric lamps are furnished free when the house is connected up for electric service. This offer is only good for wiring contracts signed before January 1, 1908. As a still further inducement the company is also offering to install an electric flat-iron and a special flat-iron switch for only $5.

The company believes that the thirty-day approval proposition for installing the electric flat-iron is the easiest and most successful method of placing these current users among their customers.

Three hundred have been put out in the last few months and each and every iron has been thoroughly demonstrated before it is left at a residence.

Direct-by-mail and newspaper advertising was used to start their flat-iron campaign, it being directed to call the people's attention to the fact that a solicitor would soon be around to leave an electric flat-iron on thirty days' free trial at all wired residences.

After fifty irons were sold, the company considered that they had placed a good, firm stepping-stone, inasmuch as they had fifty well-pleased customers who told their neighbors all about the advantages of the electric flat-iron.

The company also carried on a few months ago a cooking demonstration which they considered did them considerable good.

Every lady who registered while the demonstration was going on received a card entitling her to a chance in the drawing for an electric iron.

On the last night the winner received the iron.

During the demonstration several pretty high-school girls were ironing with an electric flat-iron and they attracted a good deal of attention.

The newspapers took notice, commenting on the novelty of a practical demonstration in a large show window by local young ladies.

On the opening day Miss Anna B. Lyons, of the General Electric Company, served a wholesome and dainty little electric luncheon to the Elgin Press Club, which assured good newspaper notices for the balance of the demonstration.

Miss Lyons also served an elegant menu for a six o'clock dinner to the mayor, A. E. Price, and wife and members of the council and their wives.

Her menu for the two different occasions consisted of macaroni, porterhouse steak, Parker House rolls, strawberry shortcake and coffee.

The Policy of Jolly.

The average man wants to be pleased rather than benefited. He is after what he wants rather than what he needs. In other words, he likes to be jollied. And by "jollied" we do not mean tickled into surrendering his better judgment, but reached and pleased by sincere courtesy and won and retained by accommodation.

Mr. Average Man is going to use electric light if electric light pleases him. But he will use something else if that something else pleases him more.

Now, to please Mr. Average Man does not only mean for him to feel that electric light is a better light. Nor does it mean that he is getting a better value for his money. It simply means that he is made happier by doing business with the electric company.

In this sense courtesy and accommodation are the jolly. And dignity rather than frivolity is its essence.

Jolly of this kind must comprise: courtesy from every one; from the telephone operator to the central station manager, all the time from the first suggestion of a prospect to the end of business relations; fairness in rate and every condition; justice in treatment by every department all the time; consistent adherence to contract; liberality coupled with strict impartiality in construing of terms.

Honesty is everything. Make the people feel that they they can not get along, not merely without electric light, but without

your particular company. But don't tell them that. Let them discover it.

Such jolly will be a business-bringer, a friend-maker, the best foe to irresponsible agitation and municipal ownership.

HEAT
All The Heat In The Iron
RIGHT WHERE YOU WANT IT AND NEED IT.
WITH an Electric Flat Iron you can iron easily, quickly and comfortably. It saves work because there is no trotting back and forth from ironing board to stove, no hot fire to tend or hot kitchen to work in.
Turn on the switch and in a jiffy you have a hot iron which stays hot as long as necessary.
30 Days Free Trial of an Electric Flat Iron
That you may prove to your satisfaction that ironing with an Electric Flat Iron means comfort and convenience, we offer you a Free Trial for Thirty Days of an Electric Flat Iron. If not satisfied at the end of that time return the iron. If satisfied—pay for it. This trial will enable you to judge for yourself. Write, phone or call on us today.
LIGHTING DEPARTMENT
Aurora, Elgin & Chicago R. R. Co.
No. 1 Chicago Street
Chicago Phone 389-390 Interstate 27

A particularly good mailing card used by the Aurora, Elgin & Chicago Railway Company to introduce the electric flat-iron into the homes of its patrons.

Courtesy should be the carefully developed characteristic of the company and every one of its people. The prospect should be approached courteously. It is

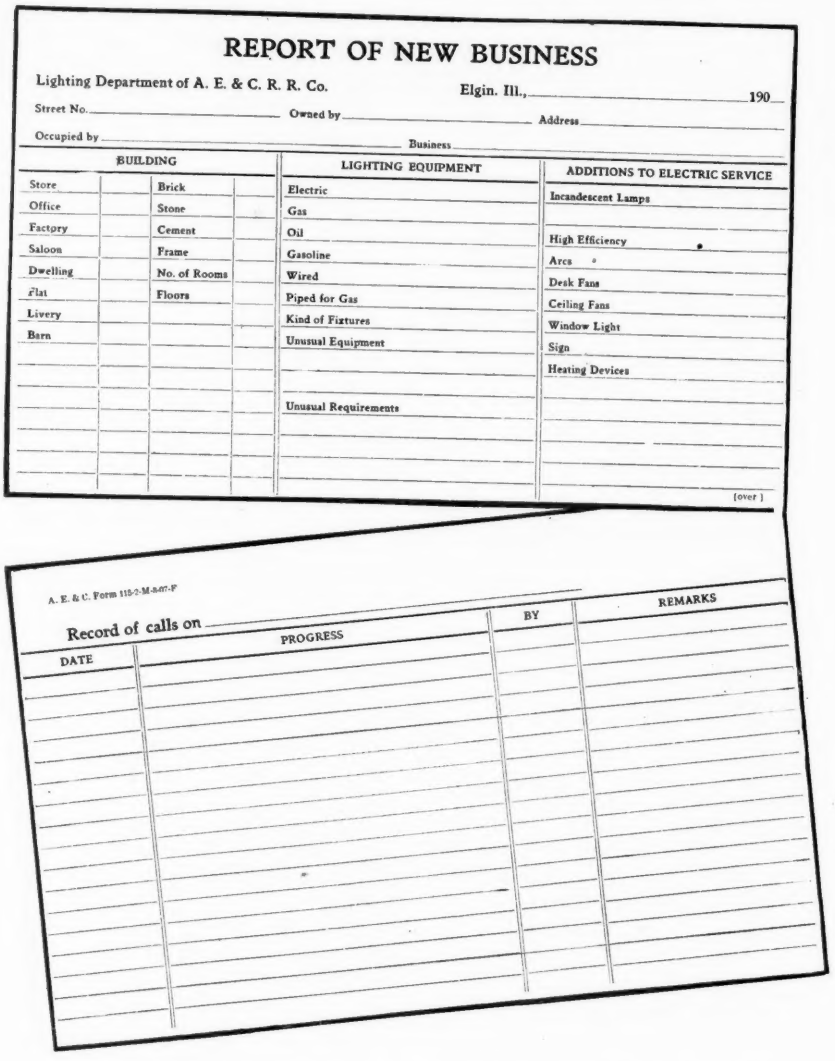
The Milwaukee Railway and Light Company is a user of high-grade direct-by-mail advertising, and we are pleased to publish a reproduction of one of its advertising booklets, which was compiled and gotten out by the advertising manager, C. W. Lamb.

a mistake to think that courtesy is a weakness or a sign of inferiority or that brusqueness is an indication of strength. Courtesy is simply a well-mannered sincerity and sincerity is always a strength.

The solicitor, or some official acting as a solicitor, is generally the first representative (won't some gifted word-coiner please give us a shorter term?) of the company to approach the prospect, and that prospect's future relations with the company depend to a large extent upon that solicitor as well as on that first approach. This approach should no more be with a "thou art greater than I" air than it should indicate an "I am greater than thou." Nor should it be a case of "I'm a good fellow, come do me a favor." It should be as one self-respecting man to another self-respecting man; and the whole conversation should be turned to the disposition and humor of the prospect. Only, never let a man say "No." Leave a ragged edge to pull back by if he is rebellious; to make a good landing place if he is receptive. Don't try to convince him of his ignorance, no matter how apparent it may be; don't impose your own knowledge, no matter how great. Leave out technical terms. Talk simply and plainly. Always use the shorter word and let him discover your knowledge. He'll do it more quickly—and convince himself more firmly—that way.

When the prospect comes into contact with the central station office this same courteous method should rule. The result will be that Mr. Prospect will discover that he likes to come over and chat and do business with you. That is the kind of spirit that lasts over night. And over several nights.

This same courtesy should mark the wireman who installs his lights, the meterman who reads his meter, the cashier who takes his money, the clerk who hears his complaints and the official who rectifies them. Train him so that whenever he comes to the office, or a company man


REPORT OF NEW BUSINESS

Lighting Department of A. E. & C. R. R. Co. Elgin, Ill., _____ 190__

Street No. _____ Owned by _____ Address _____

Occupied by _____ Business _____

BUILDING				LIGHTING EQUIPMENT	ADDITIONS TO ELECTRIC SERVICE
Store		Brick		Electric	Incandescent Lamps
Office		Stone		Gas	
Factory		Cement		Oil	High Efficiency
Saloon		Frame		Gasoline	Arcs
Dwelling		No. of Rooms		Wired	Desk Fans
Flat		Floors		Piped for Gas	Ceiling Fans
Livery				Kind of Fixtures	Window Light
Barn				Unusual Equipment	Sign
					Heating Devices
				Unusual Requirements	

(over)

A. E. & C. Form 115-2-M-8-07-F

Record of calls on _____

DATE	PROGRESS	BY	REMARKS

Showing both sides of the neat and concise card used by the Aurora, Elgin & Chicago Railway Company in keeping track of prospective business.

goes to him, he smiles, not frowns. His friends will be influenced then, too.

Such a policy does not mean that the company's interests shall be sacrificed one iota. It means that they will be more easily safeguarded. Of course, there are some grouchies that all the Chesterfields in the world can't sweeten. They need the club. But remember that the club is as great a sourer of Chesterfields as sugar is a sweetener of the minor grouchies.

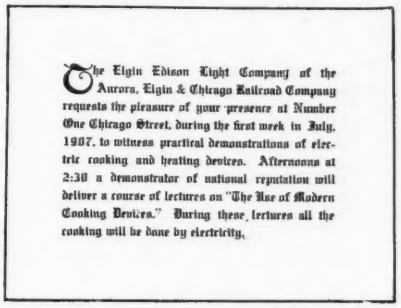
Then, after your prospect has become a user don't drop him. Go see him once in a while and talk about the ball game or the fishing. Don't mention business but listen to his little song of woe, when he has one, and straighten him out promptly and courteously. Don't tell him so, but let him gently discover that you think him a gentleman and a good fellow. Most men like to be liked. It is surprising how many good men carry a contradictory exterior, and it only takes a little sincere courtesy to turn up the better soil.

This is addressed to the solicitor so far, but it is to be remembered that every one who works for the company is a solicitor in a way and does his part to bring or repel business. The best solicitor on earth is useless if the conduct of the entire force from boy to boss, from the day the prospect is sighted hull down on the business sea until the long hereafter of his association with the company, is not of such courtesy as has been outlined.

Fairness in charges and in every other consideration of business is as essential as courtesy. No one likes to be overcharged. Honest men do not want to be undercharged. Every one wants to be treated fairly. That is natural. Convince your customers that your charges are fair. If they are less than those in some similar city, tell them why so they can understand the advantage. If more, show them why, so they can see they are being treated fairly and are not being bled. If you want to make an enemy out of your best friend, let him think he is being bled. Whether it is true or not doesn't matter.

Justice and impartiality must go hand in hand with fairness. While the contracts are consistently adhered to and liberally construed, be absolutely impartial. A good many people want advantage over others. No one wants others to have advantage over him. Nothing makes a man so sore as to discover, or think, another is getting the best of it. And the fact that a man is getting favors over his competitor does not lessen his anger when he finds his competitor is getting a few that have passed over him. No station manager can balance a favoritism programme, so the only winning policy is impartiality.

It is also but simple justice, as well as good business, to care for the trade. The treatment should not only be courteous. It should be so thorough that a complaint could never be a kick, only a notification


The Elgin Edison Light Company of the Aurora, Elgin & Chicago Railroad Company requests the pleasure of your presence at Number One Chicago Street, during the first week in July, 1907, to witness practical demonstrations of electric cooking and heating devices. Afternoons at 2:30 a demonstrator of national reputation will deliver a course of lectures on "The Use of Modern Cooking Devices." During these lectures all the cooking will be done by electricity.

A neat little invitation sent out by the Elgin Edison Light Company to notify ladies of the electric cooking demonstrations.

of something wrong. And that wrong should be righted at once. Meters should be set when requested, motors attended to when wanted, every attention given details so that no customer may lose one cent of

Wire Your House
AND GET AN ELECTRIC FLAT IRON
FREE!

¶Between July 15th and September 30th, the Elgin Edison Light Co. will GIVE AWAY free of charge, an ELECTRIC FLAT IRON to every houseowner who signs a house-wiring contract. The electric flat iron is not to be used in any other house than the one specified in the contract.

¶You can save money by wiring your house while it is under construction.

¶Electric flat irons sent out free on thirty days' trial. Are you one of the 300 users in Elgin?

Our Solicitor Will Call

ELGIN EDISON LIGHT CO.
NO. 1 CHICAGO STREET
Chicago 'Phone 389 Inter-State 'Phone 27

A newspaper advertisement run by the Elgin Edison Light Company during the time it was offering a special inducement for parties having their homes wired.

money, one moment of time, nor have one bit of worry on account of the company.

The irresponsible agitation against corporations and the growing demand for that "king bee" fallacy of fallacies, municipal ownership, are founded on competent complaint—the inconsiderateness of such corporations. Exaggerated it certainly is, harmful it has been, more harmful it will be. Its remedy is education and consideration. The people would rather be done by a corporation—*i. e.*, municipal—they think they manage than by one they know they do not. Let them see that your company is giving them part of the running. Let them feel that you are such a good fellow that they not only want your light, but want to do business with you. Then they will drop their fancy ideas and you will get the money.

Remember it is not what you do, but what people think you do, not what you are, but what they think you are, that counts. That's why some good men are downed and some bad ones boosted. See that you are boosted and be worth it.

There are no new truths in this paper. They are simply old truths brought out again, as they are so apt to get lost in the rush and shuffle of business and its attendant manifestations of human passion.

Public Lectures on Electricity.

The department of education of the city of New York announces the following public lectures on electricity: Public School No. 62, Hester, Essex and Norfolk streets, course of ten lectures on "Principles and Practice of Electrical Engineering," by W. Wallace Ker, of the Hebrew Technical Institute, Mondays, beginning October 7. Public School No. 2, Third avenue, between 169th and 170th streets, course of ten lectures on the same subject by Mr. Ker, on Fridays, beginning October 11. Public School No. 116, Knickerbocker avenue and Grove street, Brooklyn, course of eleven lectures on the same subject by Mr. Ker, Thursdays, beginning October 3. Public School No. 133, Butler street, between Fourth and Fifth avenues, Brooklyn, course of ten lectures on "Magnetism and Electricity," by Professor Charles L. Harrington, Thursdays, beginning October 10.

Wireless Telephones in the Navy Department.

It is announced that the Navy Department is installing wireless telephones on the United States warships, to supplement the wireless telegraph equipments. The battleships Connecticut and Virginia have been equipped with wireless telephones, and it is expected that as many of the battleships which are to start in December for the cruise to the Pacific as possible will be fitted with these instruments before they begin the voyage.

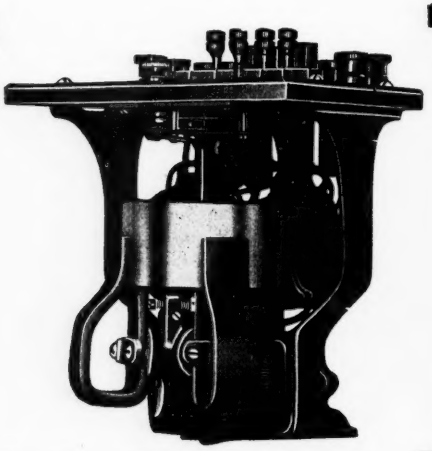
INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

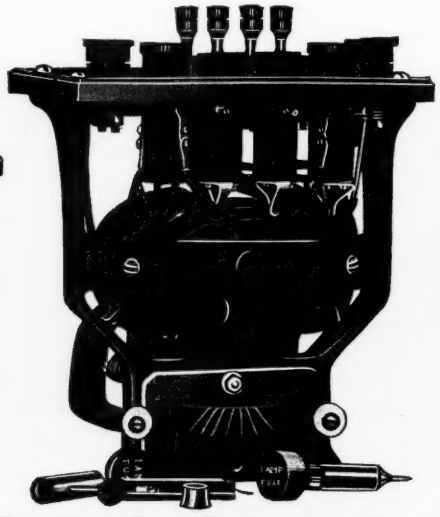
Fort Wayne Portable Watt-meter Calibrators.

Central station men are more and more realizing the importance of calibrating meters in service at regular intervals. At a recent meeting of the Northwestern Electrical Association, one of the speakers demonstrated the importance of the regular testing and calibrating of service meters by indicating a saving to the company which ran into figures that astonished every one present. This, of course, was in connection with the service mains of one of the largest companies in the country, but it is a fact that no system is so small, or the time of the operator so valuable, that it will not pay to periodically calibrate the service meters, in order that the company may receive a proper compensation for the energy delivered.

FORT WAYNE TYPE KM-1 CALIBRATOR WITH COVER OPEN.



FORT WAYNE TYPE KM-1 CALIBRATOR REMOVED FROM CASE.



FORT WAYNE TYPE KM-1 CALIBRATOR—BACK VIEW, REMOVED FROM CASE.

While there is no question as to the accuracy of the stop-watch method of calibrating meters in connection with standard indicating instruments, a quicker method is often desired because of the lack of time at the operator's disposal, and the number of meters which have to be tested in a short period of time.

The Fort Wayne Electric Works, Fort Wayne, Ind., has developed the type KM-1 calibrator, with which no stop-watch is required except in the standardizing instrument itself. Another feature in connection with this instrument is that it is not essential that the load be constant. It is only necessary to observe the revolutions of the meter under test and the pointer indications of the calibrator before and after the test, from which, by the use of proper constants, the watt-hours registered by the meter under test and the calibrator may be tested. The calibrator is so designed that it covers the range of most meters in service from light to full load for either 110 or 220 volts, two or three-wire circuits. The accompanying illustrations give a good idea of the details of these calibrators.

The calibrator is enclosed in a mahogany carrying case provided with a carrying strap for use in transportation. The case is of a convenient size, the overall dimensions being eight inches by eight inches by ten and one-quarter inches high.

The register is located on the top of the calibrator. The dial is two and three-quarter inches in diameter and provided with three pointers, the largest of which reads directly in revolutions, being connected directly to the shaft, and which in turn drives the units and tens pointers through the medium of two 10.1 reductions.

Directly in front of the dial is located a small knurled thumb-screw by means of which the rotating element may be raised from the jewel and locked firmly in transportation.

The rear section of the top of the calibrator constitutes the terminal plate to which all connections are made.

Each calibrator is furnished with a set of current and potential leads. On one end of each of the current leads is a small punched terminal for connection to the binding posts of the calibrator. The potential leads are provided with a plug at one end for connection to the calibrator. The other ends of these leads have spring clips for connection to the line. In series with the leads is a pendant snap switch by means of which the operator controls the shunt circuit and rotation of the calibrator.

The top bearing is located in the top plate of the register and is easily accessible by removing the glass and pointer over the dial. The lower bearing consists of a cup diamond jewel mounted in a post set on a carefully selected spring to take up sudden jars which might be caused by setting down the instrument while the pivot rests on the jewel. The lower end of the shaft is provided with a removable pivot in order that the lower bearing may be replaced without replacing the entire shaft.

The entire calibrator may be lifted out

of the case by removing the screw under the strap in the bottom of the case. The top plate is made of hard rubber in two sections, all of the connections being made on the rear section. This feature permits the removal of the register and rotating element without interfering with the connections.

The windings selected as most suitable for meter testing are one, two, five, ten and twenty amperes and 110 and 220 volts. With these windings meters up to and including twenty-five amperes, two-wire, either 110 or 220 volts, and up to and including twelve and one-half amperes, three-wire, 220 volts, may be tested. The ampere turns of all the windings are equal, therefore the torque is constant when the meter is operating on a given percentage of full load for any of the different windings.

In checking the calibrator the same rules are followed as in testing standard type K meters with the possible exception of the formula, which with the constants furnished with the calibrator becomes:

$$\frac{3600 \times \text{rev.} \times \text{calibrating constant}}{\text{seconds}} = \text{watts registered by calibrator.}$$

Each calibrator is furnished with a complete list of calibrating constants (reading in watt-hours per revolution) corresponding to the different capacities.

In operation the calibrator is placed in a level position and the rotor lowered by means of a knurled thumb-screw on the top. The proper current lead terminals should be connected to correspond with the stamped binding posts on the calibrator, these connections remaining the same for all circuits. The other terminals of the current leads are connected to the meter under test and the line, according to instructions furnished with each calibrator and pasted on the inside of the lid. Different current capacities are obtained by plug switches, which are also fully explained in the instructions.

After making the proper connections for calibrator and meter under test, a reading of the dial is taken. The calibrator is then started simultaneously with the counting of the revolutions of the meter under test and stopped after the desired number have been taken. The pendant snap switch connected to the potential leads is provided for this purpose. The difference between the first and last reading of the calibrator gives the total number of revolutions. The watt-hours registered by both meters are the product of the revolutions and their respective calibrating constants. These constants being the watt-hours registered per revolution, therefore the relative accuracy of the meter under test is shown by the ratio of the watt-hours registered by the two meters. After the test has once been started it need not be stopped until the desired number of revolutions has been taken, as any change in the external circuit affects similarly both the meter and calibrator. For the convenience of the operator, each calibrator is accompanied with a printed card transforming the calibrating constants marked on cups of standard type K meters to calibrating constants reading in watt-hours per revolution so they may be used in this formula.

Black Enameled Wire.

When magnet wire of extremely small sizes is used, the standard method of insulating with a single or double covering of cotton or silk has several drawbacks, one of which is the large amount of space occupied by the insulation in proportion to the size of the wire which it covers. In the case of cotton, and, to a less extent, silk, the space occupied by the insulation is a very serious factor. This proportion increases as the size of the wire diminishes, so that in the case of very fine sizes, from twenty-five to seventy-five per cent of the available space on a magnet may be taken up by the insulation of the wire. The matter of cost is another factor, as the silk used for this purpose costs the manufacturer from $8 to $10 a pound, so that in buying a pound of fine magnet wire a considerable percentage of the weight is made up of this expensive material. Another objection which has been raised to the cotton and silk-covered wire is that while these materials are excellent conductors when dry, they have a tendency in humid atmospheres to take up moisture, which thus reduces their dielectric capacities.

There have been many attempts made to produce an insulation which would afford the proper protection as a dielectric and at the same time have those characteristics of flexibility and thinness that would allow of its use an an insulator for fine magnet wires. Recently it was pointed out in an editorial in this journal that if aluminum wire were used advantage might be taken of the tendency of this wire to form an oxidizing surface which might be of value as an insulator, thus increasing the capacity of a given spool for many more turns of fine magnet wire. This, however, would involve the utilization of a material which does not possess some of the characteristics which make copper so useful for winding magnets.

A great step in advance in this respect has been made by the Western Electric Company, Hawthorne, Ill., which has, during the last four or five years, developed an insulated wire which is known as "Black Enameled Wire." This meets all the conditions found in practice in a satisfactory way, and has been manufactured by the company on a commercial scale. It has been used in the company's own apparatus for the last four years with extremely gratifying results. The success with which this new type of insulated wire has met in the short time it has been on the market has been so great that the company has found it necessary to greatly increase its capacity for manufacturing black enameled wire.

The enameled insulation is an elastic yet resistant and firmly adhering film which is applied to the wire by specially constructed machinery. The insulation is exceedingly inert toward the ordinary agencies met in practice which cause silk and cotton insulation to rapidly deteriorate and lose their value as insulating mediums.

The enameled insulation will carry current and withstand heat for a long time, being capable of withstanding a temperature as high as 500 degrees Fahrenheit without injury to its insulating qualities, although its elasticity will be reduced. Providing the windings are not disturbed, the insulation is as effective as before undergoing this severe test. Also, excessive conditions of humidity have little or no effect on this enameled insulation. While the black enameled wire is not waterproof, it is proof against the moisture of the air. Test pieces were made of No. 34 gauge copper wire, enamel insulated, consisting of 600 turns of wire wound tightly on a one-half-inch copper mandril. The insulation resistance between the wire and the mandril at the beginning of the test was found to be 7,000 megohms. After seventy-two hours in an atmosphere of ninety degrees humidity the insulation was found to be unchanged. The humidity was then raised to ninety-nine degrees and the test pieces kept at this temperature for twenty-four hours, after which the resistance was still two megohms. While in this condition the test piece was subjected to a breakdown test and withstood 350 volts alternating current. When black enameled wire has been directly submerged in water it has been found at the end of seven hours that the resistance averages about one-tenth megohm, or 100,000 ohms insulation resistance.

The enamel shows great resistance to chemical reagents, dilute acids or alkalies having little or no effect upon it. It is also insoluble in such organic substances as alcohol, benzine, turpentine and petroleum.

"Economy." Refilled Lamps.

In the issue of the ELECTRICAL REVIEW for September 14, which was largely devoted to the progress made in the art of lamp manufacture and the developments of illuminating engineering, one feature of this advance to which attention might have been called, and which was crowded out, was the improvement in the product of the manufacturers of refilled lamps. When the production of refilled incandescent lamps was first begun, the lamps were looked upon with a great deal of prejudice, and in the experimental stages of the process great difficulties were experienced in rehabilitating a lamp so that it would pass the inspection of critical users. The principal troubles were the failure to produce the close assortment necessary for perfect illumination and required length of life, the larger percentage of the lamps quickly developing filament defects in service. This required close attention and the adoption of all the best methods and appliances utilized in lamp-making. Gradually the effects have been overcome, until at the present time many exacting users are being well satisfied with refilled lamps.

NEW FACTORY OF THE ECONOMY ELECTRIC COMPANY.

One of the foremost manufacturers of refilled lamps is the Economy Electric Company, of Warren, Ohio. This company has recently erected a three-story brick building containing more than 14,000 square feet of floor space, devoted entirely to refilling incandescent lamps. The company has ingeniously adapted to the use of the refiller all of the latest patented processes necessary for the production of a perfect lamp. It subjects the refilled lamps to a thorough processing, first cleansing the old bulb, and gives each point of manufacture a rigid inspection and test under expert supervision.

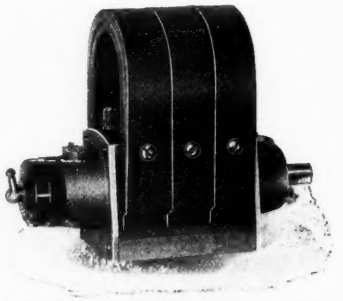
New Low-Tension Magneto.

A marked increase in the use of magneto ignition has accompanied the growth of the automobile industry. The magneto is now considered an important factor in the equipment of not only high-priced automobiles, but wherever improved and advanced devices are considered as essential and as adding to the worth of the machine itself.

The method of driving magnetos by gears or chains direct from the engine itself insures a supply of energy for ignition at correct and regular intervals. Reliability, ease of maintenance, simplicity, uniform quality and strength of spark, are all vital properties in any ignition system. The magneto is simple and eliminates complicated wiring with the attendant dangers of short-circuits and avoids the use of vibrating spark-coils and batteries.

The General Electric Company, Schenectady, N. Y., has recently developed a magneto which embodies the most desirable features of construction as determined from its past experiences in other lines of work. This magneto is of the low-tension type and differs mechanically in many respects from other machines on the market at the present time. The general construction is most substantial and without superfluous trimmings.

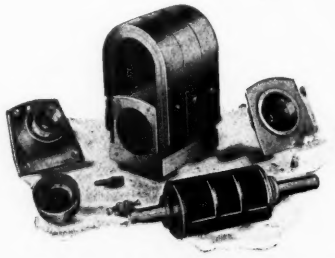
Lubrication is effected by the use of waste packing in the same manner as has been successfully applied in connection with General Electric Company's automobile motors. Generous oil wells are provided with overflow holes to prevent excessive lubrication. The type of bearing used eliminates the small wick-oiling device heretofore so often used, and insures the ample lubrication necessary for these machines. The oil wells are readily accessible, and when covers are in place, are dust-proof and will operate for months without attention. Oil baffles are provided on both ends of the armature to prevent oil from working into the armature and interior parts of the magneto. Ample bearing surfaces are provided, as well as a shaft of large diameter to insure strength, rigidity, and a minimum amount of wear.



NEW G. E. LOW-TENSION MAGNETO.

Both the base and bearings are of bronze and finished with a sand blast which produces a very attractive appearance. Bronze has been found a more satisfactory metal than aluminum for this use. The general appearance of this magneto is shown in the accompanying illustrations.

A number of especially desirable features are noticeable in the construction of the armature. One end of the armature winding is brought out through the hollow shafting by means of a steel conductor. The insulation bushing between the shaft and this conductor is of bone, and is therefore little affected by moisture or light. The current is carried from the steel conductor by means of a phosphor-bronze spiral spring to the lever nut which forms the outside terminal, thus avoiding any loose contacts. A hard rubber cover screwed to the bearing carries the contact with all its parts. This cover is provided with a knurled exterior. The grounded side of the armature winding is firmly fastened to the core, and a carbon brush insures good contact be-



PARTS OF NEW G. E. LOW-TENSION MAGNETO.

tween armature winding and frame or ground.

The magnets are of the double type, sprung on the frame and secured by one screw on each side, thus minimizing the detrimental effect of drilling the magnets. The long experience of the General Electric Company in producing millions of permanent magnets for meters and instruments has materially assisted in the production of permanent magnets for these magnetos. The bearings being screwed to the top and base of the frame, rather than to the poles, results in minimum drilling of the pole-pieces, thus further improving the properties of the magnets. The demagnetizing of the field magnets is prevented by avoiding a complete breakage of the permanent flux by making the armature core slightly overlap the pole-gap when it is in a vertical position.

The design of the armature allows generous insulation and also permits two other important advantages. With this magneto, an open-circuit voltage of over 100 volts is easily obtained, while a short-circuit current of approximately 0.4 of an ampere is available. In order to secure this high short-circuit current, the resistance of the armature winding is as low as possible, while the number of turns is sufficiently high to give an adequate open-circuit voltage.

"Sirius" Colloid Lamps for Train Lighting.

While the development of the art of train lighting has called for the application of lighting units which are far in advance of the old-style oil lamps, the full value of some of the newer forms of electric lamps does not seem to have been entirely appreciated. The gas-lighting systems are, of course, a vast improvement over the oil lamps, but there is some prejudice against the employment of the gas units, because of the wide separation of the spots of light, and also because of the alleged danger to the car equipment due to the storage tanks carried underneath the floor of the car. The objection to the gas system because of the separation of the light units has been largely overcome due to the proper use of scientific glassware, but the danger from explosion and conflagration has not been eliminated.

It is in train lighting particularly that small units of light appear to be of great advantage. These may be subdivided and multiplied so as to secure perfect distribution, and the element of danger is, of course, reduced to a minimum.

There has been considerable dissatisfaction in the operation of both axle-lighting and storage-battery systems due to fluctuations in the voltage, which, of course, affect the illumination secured from the lamps. The newer forms of incandescent lamps, however, are eliminating, in a large part, this objection, as one of the well-recognized characteristics of these lamps is their better regulation on circuits where the voltage is fluctuating. The greater economy of the newer forms of lamps is also a great boon to the train-lighting proposition, as even when small amounts of power are utilized for the train lighting, the effect is appreciable on long runs, particularly where high grades are encountered.

A long step toward the solution of several of these difficulties was made when Dr. Hans Kuzel, of Vienna, perfected the "Sirius" colloid lamp. This burns very successfully at an efficiency of one watt per candle, and has also an added feature of value in that it burns well on low-voltage circuits. As a consequence of the method of manufacture of the colloid filaments, these lamps stand the jarring and vibration of railway service very satisfactorily. The life of the lamp is also worthy of note, aside from the question of efficiency. Life-test curves based on official tests made in the government laboratories of Austria show a remarkable maintenance of candle-power, even throughout a life of 4,500 hours. These lamps have been reduced to a commercial basis abroad, where several recently established factories are turning out over 10,000 daily, the manufacturing facilities being increased as fast as possible. The lamps are not yet made in America, although limited quantities are being imported, pending the completion of arrangements for their proper development in this country.

The Efandem Company, 201 East Sixteenth street, New York city, is the American distributor for the Kuzel "Sirius" colloid lamp.

Lighting in Portuguese West Africa.

Angola, one of the most important of Portugal's possessions in West Africa, promises to become an important field for the exploitation of the electrical engineer, especially for lighting, for the principal towns are contemplating the introduction of electricity. A concession was granted in 1906 to an Italian engineer for the lighting of Benguella, Catumbella and Lobito with electricity. The number of lamps for the respective towns were fixed at 1,000, 300 and 100 for the first year, for which payment was to be made at the rate of $14 per lamp, the municipalities retaining the right to increase or decrease the number after the expiration of that period. The vice-consul at Benguella reports that a British syndicate has taken over the concession. The motive power is to be derived from the Catumbella river at a point four miles above the town of that name. The British consul writes that Loanda is at present badly lit by petroleum lamps, and that the municipality are negotiating in Paris for a loan to cover the cost of electrical installation. It is proposed to place the order for the necessary plant with a Paris firm of electrical engineers in the event of the loan being granted. The present primitive arrangements for lighting the town have been in existence since 1900, when the gas company suspended operations in view of the unexpected rise in the price of coal and the refusal of the municipality to allow a corresponding rise in the rates of payment stipulated in the contract. The municipality paid at the rate of $2.30 per 1,000 cubic feet, whereas the company estimated that gas could not be produced at a profit under $3.78 per 1,000 cubic feet with a daily consumption of three tons of coal at $11.25 per ton.—*Electrical Engineer, (London), September 27.*

The New York State Independent Telephone Association.

The following officers were elected at the meeting of the New York State Independent Telephone Association held at Syracuse, N. Y., September 25: President, J. H. Griswold, Albany; vice-president, Wilbur H. Johnson, Buffalo; secretary, R. Max Eaton, Niagara Falls; treasurer, R. Fuller, Rochester; executive committee: B. T. Bellander, George B. Wright, Williamsport; J. H. Griswold, Wilbur H. Johnson, and C. H. Poole, Utica.

The members of the executive committee were elected delegates to the convention of the International Independent Telephone Association, which will be held during the electrical exhibition at the Coliseum, Chicago, Ill., some time early in January next.

Current Electrical News

DOMESTIC AND EXPORT.

ELECTRIC CARS IN ST. PETERSBURG—The electric car lines built by the Westinghouse Company have been put in operation. They have been ready for months, but a lack of skilled mechanics in the power-house delayed their use.

WILL ISSUE $1,250,000 BONDS—The Denver & Interurban Electric Railroad, which is an auxiliary of the Colorado & Southern, has made a first mortgage to the Guaranty Trust Company, as trustee, to secure an issue of $1,250,000 six per cent bonds, maturing July 1, 1937. The road is under construction from Denver, Col., to Louisville Junction, about sixteen miles, and from that point to Boulder will use under lease Colorado & Southern tracks, aggregating twenty-eight miles, which are to be electrified. The stocks and bonds are all held in the treasury of the Colorado & Southern.

BROOKLYN RAPID TRANSIT ASSESSMENT REDUCED—Ex-Supreme Court Justice Abraham R. Lawrence, the referee appointed by the Supreme Court to report upon the claims of the various railroads comprising the Brooklyn Rapid Transit system to have the assessments imposed upon them for the year 1899 by the commissioners of taxes and assessments reduced, has filed his reports in the office of the county clerk in Manhattan. The original assessments as made by the commissioners of taxes and assessments amounted to $14,013,000, and the assessments which Judge Lawrence finds should be made aggregate $7,524,142.95, being a reduction of $6,488,857.05.

NEW MEXICAN POWER COMPANY—The Companie Electrica y Irrigadora, a new irrigation and power company, has been established with a capital of $4,750,000, with headquarters in Pachuca, Mexico. The company, which is composed largely of German and English capital, has secured control over enormous water power. It is already furnishing several towns, among them Juendo and Elba, with power and light, the latter two alone receiving 7,000 horse-power. Plans have also been formulated for another plant in the city of Telepango. The company is doing a great deal of good in the agricultural districts, and already many hitherto dry haciendas have been supplied with water for irrigation purposes.

NEW CHICAGO TRACTION PLAN—A new plan for the reorganization of the Chicago Union Traction properties, necessitated by the Circuit Court of Appeals decision overruling the former plan, has been drafted by A. M. Beitler and William Burry, of Philadelphia, counsel for various interested persons. The plan is designed to meet the objection of the court that the bondholders had not sufficient preference in the plan. The principal changes consist in increasing series A bonds from a total of $15,900,000 to $20,366,000, reducing series B bonds from $16,900,000 to $9,734,000 and increasing series C from $5,000,000 to $7,000,000. The plan thus enhances the value of the North Chicago street railroad firsts, the West Chicago street railroad firsts and the tunnel bonds.

NEW TRACTION COMPANY FORMED IN MAINE—The Minneapolis, St. Paul, Rochester & Dubuque Electric Traction Company, with $25,000,000 of authorized capital, has filed its certificate with the Maine secretary of state. The capital is to be in $100 shares, to be divided later into common and preferred stock. Fourteen shares of common stock are issued, one each to Eben Winthrop Freeman, E. L. Rackliffe, Fred V. Matthews, Frederick L. Jerriss, Wilford G. Chapman, William H. Looney, Charles M. Drummond, Wadleigh B. Drummond, of Portland, Me., and M. W. Savage, W. D. Boutell, E. B. Savage, T. W. Stevenson, M. H. Boutelle and D. W. McKenna, Minneapolis, Minn. The president is Eben Winthrop Freeman, who also serves as clerk, and has the clerk's office at Portland, Me. The treasurer is E. I. Rackliffe.

NEW INCORPORATIONS.

LANSING, MICH.—Citizens' Telephone Company, of Grand Rapids. Capital increased from $3,000,000 to $3,500,000.

HARRISBURG, PA.—Dillsburg & Wellsville Railroad Company. To build a trolley line seven and one-half miles long in York county. $75,000.

AUSTIN, TEX.—Staked Plains Telephone Company, of Lubbock, Lubbock county. $60,000. Incorporators: C. W. Alexander, George T. Curtis and R. C. Burns.

ELGIN, ILL.—Geneva & Batavia Heat, Light and Power Company. $200. Incorporators: Charles J. O'Connor, W. Hamilton Gallagher and R. Harold O'Connor.

INDIANAPOLIS, IND.—Citizens' Electric Light and Power Company, of Lebanon. $50,000. Directors: Richard A. Edwards, Milton A. Edwards and George R. Chamberlain.

INDIANAPOLIS, IND.—Clay City Lighting Company, of Clay City. $10,000. Directors: J. M. Lay, H. R. Vandiver, B. M. Guirl, W. H. Guirl, J. E. Conley, C. F. Nickey and J. R. Benham.

COLUMBUS, OHIO—Seaman Bell Telephone Company, Seaman, Adams county. $5,000. Incorporators: C. E. Kirkpatrick, J. V. Wickerham, L. W. Sparger, F. G. Young, W. H. McCreight, N. Osburn and J. E. Shriver.

ALBANY, N. Y.—Great Bear Light and Power Company, East Worcester, N. Y. To manufacture electricity for light, heat and power. $20,000. Incorporators: James E. Dante, Aaron D. Hollenbeck, Lucy A. Dante, East Worcester, N. Y.

SAN BERNARDINO, CAL.—The Watson Construction Company. Organized for the purpose of developing and supplying electricity and gas. $50,000. Directors: Clarence A. Watson, R. J. Dunn, Guy A. Hammell, William Medland and A. E. Breck, all of Redlands.

ALBANY, N. Y.—Mount Vernon & Eastern Railroad Company. To construct a standard gauge steam or electric railroad from Mount Vernon to Lewisboro, thirty-five miles long, in Westchester county. $1,000,000. Directors: Oakleigh Thorne, William H Chesbrough, Carleton Bunce, Howard K. Wood and Charles E. Mitchell, of New York; Marsden J. Perry, of Providence; George H. Hansel, of Cranford, N. J.; Kenneth K. McLaren, of Jersey City, and Allen Wardwell, of Lawrence, N. Y.

GUTHRIE, OKLA.—The Southwestern Interurban Railway Company, with headquarters at Mangum. To build from Mangum, *via* Francis, to Hollis, in Greer county, thirty-seven miles; from Mangum to Granite and Cordell, in Washita county, forty miles; from Granite to Hobart, fifteen miles, and from Mangum to Altus, twenty-seven miles, a total distance of 119 miles. $1,000,000. Incorporators: W. T. Funderburk, D. J. Doyle, E. E. Pinkerton, T. P. Clay, H. M. Ferguson and R. C. Echols, all of Mangum.

ALEXANDRIA, LA.—The Kent Company, Limited. Organized to purchase and sell real estate, buy and operate electric and other street railway roads, build, maintain and operate waterworks, sewer systems, light plants, etc. $100,000. Board of directors: S. Barrett, W. B. Stewart, J. A. White, T. G. Brush, E. J. Hardtner, Ben Weil, L. B. Baynard, Jr., J. H. Overton, William M. Cady, C. M. Waters and A. Albert, with the following officers: A. Albert, president; William M. Cady, first vice-president; Ben Weil, second vice-president; Roy Albert, secretary and treasurer.

NEW PUBLICATION.

STANDARDIZATION RULES OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—The revised "Standardization Rules of the American Institute of Electrical Engineers," approved by the board of directors, June 21, and adopted by the twenty-fourth annual convention, June 27, are ready for distribution. These are published by the Institute at ten cents a copy for paper cover, and twenty-five cents for cloth.

ELECTRIC LIGHTING.

ALTON, ILL.—An electric light plant has been installed at the Alton waterworks.

SAN JOSE, CAL.—The mayor and council are considering the matter of installing an electric light plant.

CIRCLEVILLE, OHIO—The Circleville Light and Power Company has increased its capital stock from $70,000 to $80,000.

WAYNESBORO, VA.—The electric light plant and pumping station at Waynesboro were destroyed by fire on September 25. The loss is $5,000, not covered by insurance.

JEFFERSON CITY, MO.—Contracts have been awarded for the new electric light and power plant to be installed in the state penitentiary. The figures aggregate $147,140.

SUPERIOR, WIS.—The plant of the Great Northern Power Company, on the St. Louis river, has been placed in operation and is now supplying the needs of Superior and Duluth.

FREDERICKSBURG, VA.—The city council has appropriated $4,000 for the work of adding to the city electric light plant an incandescent system for lighting stores and dwellings.

MAGNOLIA, ARK.—The question of the municipal ownership of the electric light plant is being agitated since the recent destruction of the plant by fire, and is meeting with general approval.

ALAMEDA, CAL.—The annual report of Alameda's municipal electric light plant shows the year's operating expenses to have been $44,491.75, with gross earnings of $71,447.58. The net earnings were $26,956.58.

CLEVELAND, OHIO—James W. Ellsworth has presented his native town, Hudson, Ohio, eighteen miles from Cleveland, with a municipal lighting plant, waterworks and a sewerage system, the three to cost $70,000.

RENTON, WASH.—The city council has voted to take steps preliminary for the installation of a municipal electric lighting plant to cost about $25,000. A committee was appointed to investigate and report to the council.

MUSKOGEE, I. T.—The ice and light plant at Phillips, which supplied the towns of Lehigh, Colgate and Phillips with ice, has been burned to the ground. It will be rebuilt. In the meantime all three towns will be without light.

EVANSTON, WYO.—The Aspen tunnel of the Union Pacific, a few miles east of here, is to be lighted by electricity from a plant located near one of the portals. This tunnel is the longest on the Union Pacific system, being more than a mile in length.

GARNETT, KAN.—At a meeting of the stockholders of the Garnett Electric Light Company, officers and directors were elected as follows: president and treasurer, Joe Carey; vice-president and secretary, J. Q. McAfee; directors, J. Q. McAfee, Joe Carey, Nora McAfee, Gail Carey and George Thomas.

ALLEGHENY, PA.—A bill has been introduced in the select council for the issuing of $75,000 in bonds for buying a turbo-generator outfit, condensing equipment and all necessary electrical apparatus for the extension of the arc lighting system at the municipal lighting plant on Braddock street.

WOODBURY, N. J.—A resolution has been introduced into the council authorizing the bonding of the city in the sum of $25,000 for the erection of a municipal electric lighting plant. The city is now paying the Public Service Corporation $95 per light per year under a five-year contract which will expire at the end of this year.

LEBANON, PA.—The Swatara Electric Light and Power Company has applied to the state water commission for a permit to complete a dam across Swatara Creek at an abandoned mill dam in Union township, Lebanon county. To complete this dam and maintain it for power purposes involves submerging of lands and a township road.

DAYTON, OHIO—To provide for the municipal ownership of an electric light plant, an ordinance has been introduced in the city council. The ordinance provides for submission to popular vote at the November election of a proposition to issue bonds not to exceed $500,000 in excess of the four per cent limitation for the erection and maintenance of the plant.

SUPERIOR, WIS.—Allouez and Itasca are to be furnished with incandescent electric lighting service by the Superior Water, Light and Power Company. The work of putting in the line has been commenced. It is planned to run a main line through to the Nemadji district. From this main line feeders to the residence and business section of the suburbs will be installed.

SPRINGFIELD, ILL.—The Madison County Light and Power Company has filed a mortgage to the Central Trust of Illinois, as trustee, to secure an issue of $1,000,000 five per cent thirty-year gold bonds, subject to call on any interest date at 105, after four weeks' notice. The bonds, of which $319,000 have been issued, are guaranteed, principal and interest, by the Illinois Traction Company.

WILKES-BARRE, PA.—The councils and the Wilkes-Barre Gas and Electric Company have reached an understanding relative to the paying of the company's electric light bill. The company offered to deduct $4,000 flat from the accumulated bills, with a waiver of all accrued interest, the latter amounting to about $1,800 which means a total deduction of almost $6,000. The offer was accepted.

GLENWOOD SPRINGS, COL.—More than 500 men are regularly employed on the big power project that is being developed at Shoshone. At the present time work is being pushed on the temporary dam. There will be a drop of 185 feet at the temporary plant, which will develop 13,000 horse-power. This plant is being erected one mile above Grizzly Creek. The line to Leadville will probably be completed by spring.

CHEHALIS, WASH.—C. L. MacKenzie, of Colfax, Wash., and Ed Riggs, of Portland, have closed a deal with Harry West for the purchase of the electric light plant in this city. Mr. West has a lease on the city's lighting business which is good for about thirteen years more. The plant is located on Coal Creek, east of the city, at the mouth of a coal mine, where there is an ample supply of fuel within a few hundred feet.

SARATOGA SPRINGS, N. Y.—The village board has awarded the street-lighting contract to the Halfmoon Light, Heat and Power Company. It is to run from February 1, 1908, to February 1, 1913. The company is to furnish six or more 1,200-candle-power arc lamps at $60 per annum, and 280 twenty-five-candle-power incandescent lamps at $9.96 per annum, two twenty-five-candle-power lamps to be furnished free for each fire department house.

NORTHOME, MINN.—The village council has granted a franchise to E. E. Bigham, of Minneapolis, to construct, maintain and operate a complete electric light system within the limits of the village of Northome for a period of thirty years. The ordinance provides that the plant shall be completed and in operation by January 1, 1908, and it is the intention of the promoter to commence work as soon as a suitable site and the necessary material can be secured.

CANAL DOVER, OHIO—The question of erecting a municipal electric light plant will be submitted to the voters of this city at the coming November election. It is proposed to issue $35,000 bonds to build the plant. The contract with the company which now furnishes the lights will expire January 1, 1909. At an election some years ago a vote to empower the city council to build a plant was carried. The city now owns its waterworks plant, which has been a success.

SPOKANE, WASH.—Arrangements have been completed by the Washington Water Power Company for the extension of its power transmission lines from Mace to the Tamarack and Chesapeake mine and to other properties adjoining. It is the plan of the company to install a power plant near the Tamarack and Chesapeake mine and distribute the power to the Idora, Callahan group and other mines located in the Sunset Peak district. The original plan of running lines from Burke has been abandoned.

OZARK, ARK.—At a recent meeting of the stockholders of the electric light company of Ozark the following officers were elected: president, A. Buergler, Altus; vice-president, A. D. Reynolds, Ozark; second vice-president, W. C. Bell, Ozark; secretary, Harley Russell, Ozark; treasurer, J. J. Sax, Altus. The board of directors consists of the above officers and J. C. Harrod, of Denning; Alfred Sax, H. L.

Hembroe and Father Placidus, of Altus. The company is capitalized for $100,000, of which $10,000 has been paid in.

DUNSMUIR, CAL.—Three hundred horse-power is to be developed at the electric power plant now being built by the Southern Pacific company at Dunsmuir, near the base of Mount Shasta. This power is for the present to be used exclusively for the running of the railroad shops at Dunsmuir. Water is being taken from the Sacramento river to develop the power, and improvements are being made that will cost $20,000. No power-house will be erected, the generators to be installed in the railway shops.

HOUSTON, TEX.—The Houston Lighting and Power Company is at work installing improvements in its plant which will cost in round figures $107,000, including line improvements, when completed. The major portion of the new machinery has arrived, and it is expected that the improvements will be finished by November 1. The capacity of the plant is to be increased 2,000 horse-power. It already has a capacity of 4,300 horse-power. This will scarcely more than meet the growing demands made upon the company for light.

WEBB CITY, MO.—Charles U. Porter has been granted a lighting and power franchise in Webb City. Mr. Porter represents eastern capitalists and it is understood that the work on the plant is to be commenced soon. Contracts will be made with many mining companies adjacent to Webb City and Carterville for power, and it is understood that many of Webb City's and Carterville's residences are to be heated with the exhaust steam. The new company is to be known as the Twin Cities Heating and Power Company.

SAN ANTONIO, TEX.—An electric power line twenty-six miles long is to be built from Laredo, up the Rio Grande, to furnish light and power for the operation of the coal mines in that vicinity. The plant will cost $100,000. It will be located at the Rio Grande coal mines and will supply the mines in the district with power and light, as well as Laredo. Samuel Kahn, chief engineer of the San Antonio Traction Company, says the project is assured. In addition to supplying power for mining, the new plant will also furnish a cheap power for irrigation pumps.

CŒUR D'ALENE, IDA.—The stockholders of the Idaho Water and Electric Power Company have elected officers as follows: president, Honorable J. L. McClear; vice-president, P. J. Scallon; secretary, Maude Thornton, and treasurer, Charles G. Dawes, ex-comptroller of Chicago. Some other minor business was transacted. This company was organized for the purpose of developing the water power along the St. Joe river by the construction of many dams. The power generated will be utilized in assisting the heavy traffic across the mountains on the Chicago, Milwaukee & St. Paul Railroad. The enterprise is promoted by the railroad company.

IDAHO FALLS, IDA.—A satisfactory contract has been entered into between this city and the Idaho Falls Power and Transportation Company for supplying all the electric energy needed for light and power. The company is composed of local men and capital. They have a modern plant situated two miles below the city, with one unit of 300 horse-power already installed and the necessary room for the installation of four additional units of equal capacity. Two of these units, with the necessary machinery, have been ordered from eastern factories, and will be put in place at an early date. The company has franchises for supplying light and power to the villages of Ammon, Iona, Elva and Rigby. Large flouring mills will be supplied with power at the two latter places.

SPOKANE, WASH.—Announcement has been officially made that the Power Development Company, which is a subsidiary corporation of the Spokane & Inland Railroad Company and one of the corporations belonging to the Inland Empire system, will have a surplus of from 10,000 to 15,000 horse-power from the new power station at Nine Mile bridge as soon as the plant at that place is completed, after supplying electric power to the railway lines of the system. It is proposed to utilize this surplus power to supply light and power to the citizens of Spokane under the franchise purchased by Jay P. Graves and associates from Frank P. Hogan. This franchise was granted by the city council about five years ago to a company organized to develop the power down the river at the rapids known as the Bowl and Pitcher. The franchise was granted for fifty years and was subsequently purchased by Frank P. Hogan, who also secured the water rights at the Bowl and Pitcher rapids. These water rights passed with the franchise to President Jay P. Graves, of the Inland Empire system, who afterwards transferred the same to the company of which he is the head.

LEWISTON, WASH.—The Washington-Idaho Light and Power Company has closed a contract with the city councils of Uniontown and Colton for furnishing those towns with electric current for lighting and for pumping the city water. The company has secured a twenty-five-year franchise which allows it to use the streets for its poles. The extension of the company's lines will involve an expenditure of about $25,000. The addition of Uniontown and Colton makes ten cities in the Inland Empire that are served with light and power by the Washington-Idaho company. These towns, with Genesee, Moscow and Pullman, receive their current from the water-power plant of the Lewiston-Clarkson company at Asotin, while Palouse, Garfield, Oakesdale, Farmington and Tekoa are lighted from the Post Falls plant.

ALBANY, N. Y.—The Oriskany Hydro-Electric Company has filed an amended certificate with the secretary of state, setting forth that it proposes to carry on operations in the counties of Oneida, Chenango, Madison and Broome, as follows: Oneida county—Towns of Westmoreland, Kirkland, Marshall, Sangerfield, Augusta, Vernon, Whitestown, Paris and Bridgewater; villages of Vernon, Clinton, Waterville, Oriskany Falls, Clayville; city of Rome. Madison county—Towns of Brookfield, Madison, Hamilton, Lebanon, Eaton, Georgetown, Stockbridge, Oneida; villages of Brookfield, Madison, Hamilton, Earlville, Morrisville; city of Oneida. Chenango county—Towns of Sherburne, Smyrna, Columbus, New Berlin, North Norwich, Oxford, Greene, Smithville, Preston, Plymouth, Otselic, Pharsalia Coventry, Guilford; villages of Earlville, Sherburne, Smyrna, New Berlin, Norwich, Oxford, Greene.

TELEPHONE AND TELEGRAPH.

DEXTER, MASS.—The New England Telephone and Telegraph Company has made plans for extensive changes in its local wires.

ARKADELPHIA, ARK.—The Arkadelphia Telephone Company is making extensive improvements to its system. New poles and cables and a new switchboard are being installed.

CAMDEN, N. J.—The Delaware & Atlantic Telegraph and Telephone Company has filed the necessary $5,000 bond in the city clerk's office which authorizes it to tear up the streets for the placing of its wires underground.

ENSLEY, ALA.—The Southern Bell Telephone Company has moved into its new building on Nineteenth street. The exchange is fitted up with the latest apparatus, and many improvements have been made on the outside system, a new trunk line to Birmingham having been installed.

HUNTSVILLE, ALA.—At Arah, Ala., the Southern Bell Telephone Company has established an exchange, connecting the farmers of that section with Oleander, Red Hill, Eddy, Warrenton, Grassy, Union, Grover, Getup and Guntersville. The new connection brings in a wide area which has heretofore been without telephone service.

WILKES-BARRE, PA.—Local officials of the Bell Telephone Company have announced that the company has decided to place all wires underground. This is the first move made towards abolishing the telephone and telegraph poles throughout the city and is fulfilling the wishes of the city councils. The company will do away with nearly fifty poles and over 35,000 feet of wire.

LOUISVILLE, KY.—The Cumberland Telephone and Telegraph Company has filed an amendment to its charter increasing its capital stock from $20,000,000 to $20,200,000, and changing its official residence from Hopkinsville to Louisville. This action was taken by the board of directors of the company as the result of resolutions passed by stockholders holding 160,175 shares August 6, 1907.

MILWAUKEE, WIS.—The Independent Telephone Company will be in operation by January 1, 1909, according to the statements of one of the officials of that company. The company has all its rights of way and has completed engineering plans. It is claimed that from ten to fifteen months is necessary for the construction of buildings, erection of poles, and the building of conduits. The company plans to operate 60,000 telephones. H. D. Critchfield, manager, says that the company has received 8,400 subscribers in four months.

PERSONAL MENTION.

MR. JOSHUA T. DAY, chief electrician of the New Hampshire Electric Railways, Haverhill, Mass., has resigned to become chief electrician of the Malden, Mass., Electric Company. Mr. Day has been chief electrician of the New Hampshire system since its organization.

MR. HARVEY M. LITTELL, a former president of the American Street Railway Association and a well-known street railway and electric light man, announces his association with the Harry S. Houpt Company, agent for the Thomas automobiles. The company is situated at Broadway and Sixty-third street, New York city.

MR. FRANK STOUT, for the past nine years a salesman for I. P. Frink, is now occupying a similar position with the Bryant Electric Company, Bridgeport, Ct. Mr. Stout will represent the Bryant company in the territory controlled by the eastern sales organization, which, in general, is the country east of Buffalo and Pittsburg.

MR. PUTNAM A. BATES, 42 Broadway, New York city, the well-known consulting engineer, announces that the field of his offices has been extended to include heating and ventilating engineering. This will not be news to many people who are acquainted with Mr. Bates' work, as long before he was prepared to make this announcement, he had already engineered a number of excellent heating and ventilating systems.

MR. HERBERT H. VREELAND, who was retained as manager of the New York City Railway Company by the receivers, Messrs. Joline and Robinson, has resigned from this appointment. Mr. Vreeland finds that the demands upon his time due to personal matters and his connection with various other properties and interests are of such magnitude as to make imperative his request to be relieved. Mr. Vreeland is succeeded by Oren Root.

MR. H. R. SYKES, general manager of several independent telephone operating companies in Ohio, will join the sales organization of the Wire and Telephone Company of America during the present month. Mr. Sykes' long experience in the telephone field will prove a valuable asset in that it will be comparatively easy for him to convey his impressions of the excellent features of the "Easophone" equipments to exchange managers and subscribers. The sales organization of this progressive company has been materially enlarged, due to the popularity with which the apparatus is being received.

MR. J. K. BUTLER, who has been division superintendent for the New England Telephone and Telegraph Company at Burlington, Vt., for the past ten years, has been transferred to the offices of the general superintendent at Boston, where he will have charge of the special work department. In point of service Mr. Butler is one of the old-timers, having been actually engaged in the telephone business since 1879. He first organized a small local company at Stamford, Ct., known as the Stamford & Norwalk Telephone Company. When this company was absorbed by the Connecticut Telephone Company, Mr. Butler became superintendent. In 1886 he was employed by the American Bell Telephone Company as manager, with headquarters in Philadelphia, and afterwards became engineer of construction. In that capacity he directed the building of one of the first long-distance lines from New York to Boston. In 1890 he was transferred to the New England company, with headquarters in Boston, where he was employed as special agent until 1898, when he went to Burlington, thus making about twenty-eight years of continuous service.

NEW MANUFACTURING COMPANIES.

HARTFORD, CT.—The Meriden Light and Equipment Company, of Meriden, has been incorporated with a capital of $25,000 to manufacture and deal in electrical supplies.

PHOENIX, ARIZ.—The Automatic Retrieving Trolley Company has been incorporated with a capital stock of $1,000,000. The officers are: C. E. Lang, president; J. P. Girard, vice-president; J. M. Aiken, secretary and treasurer.

ALBANY, N. Y.—The W. F. Bossert Manufacturing Company, of Utica, organized to manufacture railway apparatus, with a capital of $50,000, has filed articles of incorporation with the secretary of state. The directors include: W. F. Bossert, H. C. Williams, Leon W. Bossert, C. G. Bennett, all of Utica. One-half the capital stock is to be seven per cent non-cumulative preferred stock. Mr. Bossert, the head of the new company, was for many years the practical head of the Bossert Electric Construction Company in Utica.

AUGUSTA, ME.—The Bromfield Electric Company, of Portland, has been incorporated at Portland for the purpose of doing a general electrical business. The capital stock is $500,000, and the officers are: president, Charles M. Drummond, of Portland; treasurer, Wadleigh B. Drummond, also of Portland.

ELECTRICAL SECURITIES.

Last week price changes were irregular, but, in the main, a steady tone ruled, and some net advances were shown for the week. The commission firms are complaining that there is very little outside speculation, and it is claimed that, with few exceptions, these firms are not more than making expenses. The professional advisers in the market expect lower prices, and despite the fact that the pressure has not been able to effect much reduction so far, the bear interests are confident that still further declines will take place. It appears to be a fact that the severe depression that has ruled for some time in the financial district is beginning to have some effect throughout the entire country. The reaction will, of course, depend upon the extent and duration of the financial depression, but conservative interests reiterate their belief that while there will be a let-up of considerable extent, it will not approach the conditions of business inactivity that were realized in previous off years.

Cincinnati, Newport & Covington Light and Traction Company; regular quarterly dividends of 1⅛ per cent on the preferred and ¾ per cent on the common stock, payable October 15. Manchester (N. H.) Traction, Light and Power Company; quarterly dividend of 2 per cent, payable October 15. East St. Louis & Suburban Railway Company; regular quarterly dividend of 1¼ per cent on the preferred stock, payable November 1 to stockholders of record October 15.

ELECTRICAL SECURITIES FOR THE WEEK ENDING OCTOBER 5.

New York:	*Closing.*
Allis-Chalmers common	6¾
Allis-Chalmers preferred	20
Brooklyn Rapid Transit	46¾
Consolidated Gas	100½
General Electric	124
Interborough-Metropolitan common	9
Interborough-Metropolitan preferred	25
Kings County Electric	109
Mackay Companies (Postal Telegraph and Cables) common	58¾
Mackay Companies (Postal Telegraph and Cables) preferred	60
Manhattan Elevated	116½
Metropolitan Street Railway	35
New York & New Jersey Telephone	100
Western Union	72
Westinghouse Manufacturing Company	122
Boston:	*Closing.*
American Telephone and Telegraph	105¼
Edison Electric Illuminating	206
Massachusetts Electric	—
New England Telephone	—
Western Telephone and Telegraph preferred	—

Directors of the Edison Electric Illuminating Company of Boston have declared the regular quarterly dividend of 2½ per cent, payable November 1 to stock of record October 15. Three months ago 2½ and 1 per cent extra were declared; a year ago 2½ per cent.

Philadelphia:	*Closing.*
Electric Company of America	8⅞
Electric Storage Battery common	44
Electric Storage Battery preferred	44
Philadelphia Electric	7⅝
Philadelphia Rapid Transit	20¼
United Gas Improvement	84¼
Chicago:	*Closing.*
Chicago Telephone	107½
Chicago Edison Light	137½
Metropolitan Elevated preferred	62
National Carbon common	70
National Carbon preferred	117

The daily average of passengers carried by the Metropolitan Elevated during September was 140,979, an increase of 14,004.

The daily average of passengers carried by the South Side Elevated Railway during September was 118,256, an increase of 28,507.

ELECTRIC RAILWAYS.

EUGENE, ORE.—A twenty-year street railway franchise has been granted A. Welch.

DENVER, COLO.—An electric line from Englewood to Littleton has been placed in operation.

MORRIS, ILL.—The Chicago, Ottawa & Peoria Railway Company has filed its written acceptance of the franchise passed some time ago by the city council of Morris.

FITCHBURG, MASS.—The Fitchburg & Leominster Street Railway Company has been granted permission by the railroad commissioners to issue additional stock to the value of $250,000.

HUDSON, MASS.—The Concord, Maynard & Hudson Street Railway Company has petitioned the railroad commission for approval of $10,000 twenty-year five per cent bonds, for additions to property.

CHICAGO, ILL.—The Chicago & Milwaukee Electric Railway will be opened for through traffic into Milwaukee by November 15. The fare will be $1.35, as compared with $1.70 on the steam roads.

MERCER, PA.—The Mercer Construction Company has awarded to J. H. Milholland, of Pittsburg, the contract for making a survey of the proposed electric railroad to connect Mercer, Sharon and Greenville.

NORTH YAKIMA, WASH.—The directors of the Yakima Valley Transportation Company have decided to abide by the original franchise granted them and will proceed with the construction of their line at once.

PITTSFIELD, MASS.—The Pittsfield Street Railway has petitioned the Massachusetts railroad commission for approval of operation of its road between Pittsfield and Hancock, and of construction from Hancock to the New York state line.

NORWOOD, OHIO—An ordinance granting the Cincinnati & Columbus Traction Company an extension of four years on its lease of city property has been passed. The company is to pay $300 per year for its occupancy of the property.

WASHINGTON, PA.—A company organized at Finleyville, and said to be backed by Pittsburg capital, proposes to build a trolley line from Finleyville to Bentleyville. The incorporators are: M. J. Hayden, T. M. Hayden, H. D. Hayden and Sid C. Wilson.

HUNTSVILLE, ALA.—Plans for the extensive improvement of the street railway and electric light systems of this city have been prepared. The plans provide for doubling the capacity of the power plant and for extensions of the railway line at both ends.

OGDEN, UTAH—The electric line from Ogden to the Utah Hot Springs, 10.2 miles north of Ogden, has been put into commission, *via* the Ogden Rapid Transit Company's lines to the north city limits and the Ogden & Northwestern for seven miles further north.

JEFFERSON, IOWA—It has been authentically stated that the new proposed electric line to be built between Rockwell City and Fort Dodge the coming year will in time extend its branch running parallel with the Milwaukee Railroad through Lohrville and into Jefferson.

AUBURN, IND.—The Toledo & Chicago Interurban Railway Company has received a check for $20,000 from the city of Kendallville as a bonus which the citizens of that town voted to the interurban company as an inducement for it to locate its power plant and offices in that city.

NASHVILLE, TENN.—The charter of the Nashville & Huntsville Railway has been amended. A material change in the original right of way and an increase in the capital stock of the company is shown. The capital stock is increased from $50,000 to $150,000. Work on the road is to begin at once.

CHICO, CAL.—The electrifying of the Butte County Railroad from Chico to Paradise, and the making of the well-known mountain resort into a summer suburban city for the well-to-do residents of Chico, is the project now being considered by D. H. Brammer, a real estate agent of Paradise.

RIVERSIDE, CAL.—An electric line is to be built from Santa Maria, Santa Barbara county, to Guadaloupe, on the coast line of the Southern Pacific. The distance is about seven miles and the road may be extended on to La Grande Beach, a summer resort not far from Guadaloupe.

SAPULPA, I. T.—The work of building the Sapulpa electric street railway has been commenced. A franchise was granted by the city council on condition that the line be completed within six months and that it be extended as a motor line to the Midland Valley Railroad, penetrating the Sapulpa oil fields.

WASHINGTON, D. C.—The new Washington, Frederick & Gettysburg Railway Company has completed its electric railway from Frederick, Md., to Yellow Springs, Md., and expects to have it completed to Lewistown within six weeks. From that point it will be rapidly pushed to Thurmont, Md.

CHATTANOOGA, TENN.—Work will soon be commenced on the construction of the forty-mile electric interurban line to connect with the Louisville & Nashville below Dalton, Ga., from this city. The Tennessee Construction Company, which is to do the work, has been organized under a West Virginia charter.

RICHMOND, S. I.—A new trolley line, to be operated from Richmond to Tottenville, a section of Staten Island now served by stages, is projected by Thomas B. McGovern, of the Broad Exchange building, and Cornelius G. Kolff, of 50 Broadway, New York city. The line will be about ten miles long and will cost $400,000.

SPRINGFIELD, MASS.—It is learned that the Springfield Street Railway Company intends to spend $465,000 on its lines during the next fifteen months. The larger part of this sum will be expended next year in Springfield, although Westfield and Ludlow will be benefited. Over $100,000 will go into a new car shop and car barn.

WASHINGTON, D. C.—Charles Hine has been appointed receiver for the Washington, Arlington & Falls Church Railway Company, operating an electric line between this city and Falls Church, Va. As the result of a wreck last summer suits aggregating $400,000 have been filed against the corporation, which has a capital stock of $100,000.

FORT MADISON, IOWA—The Fort Madison Street Railway Company has been purchased by the Mississippi Valley Electric Railway Company. The Fort Madison street-car line will become a part of the Mississippi company and will be conducted in connection with the interurban line to be constructed between this city, Nauvoo and Carthage.

TRAVERSE CITY, MICH.—Grand Traverse Railroad; to build an electric line to Elk Rapids and then on to Charlevoix; $450,000. Traverse City Street Railway Company; $25,000. Officers of both companies: John B. Carter, president; Charles A. Deneen, secretary; M. S. Sanders, treasurer. The latter company will operate a street railroad in Traverse City.

TRINIDAD, COL.—President Frank R. Read, of the Trinidad Electric Railway, says the line will be extended to Cokedale, eight miles west, and to Hastings, eighteen miles north. The city lines will also be extended to cover several streets through the south side residence district. As soon as the bonds are disposed of the proposed extensions and improvements will be started.

HIGH BRIDGE, N. J.—A new trolley line between Easton, Pa., and Flemington, is proposed, to be in operation about July 1, 1908. The proposed route will be from Phillipsburg *via* Springtown, Bloomsbury, Asbury, Hampton Junction, Glen Gardner, High Bridge, Clinton, Lansdowne, Hamden to Flemington. It is proposed to erect and equip a power-house at Hampton Junction.

POTTSVILLE, PA.—The Pottsville Union Traction Company has given orders for the construction of a trolley branch between Middleport and Tamaqua. The new line, which will be eight miles in length, will be the connecting link between the trolley systems of the lower anthracite and the upper anthracite territory. It will give a through trolley line from Orwigsburg and Pottsville to Mauch Chunk.

VANCOUVER, WASH.—At a meeting held in this city the reorganization of the Washington Railway and Power Company was effected. As a result the uncompleted track that has ornamented the business streets of the city will be completed at once and it is hoped to have the road in operation within ninety days. By the new arrangement, local business men assume control of the property. The new officers elected at the meeting are: State Senator E. M.

Rands, president; John H. Elwell, vice-president; H. C. Phillips, treasurer; M. M. Connor, secretary, and M. J. Connor, general manager. The retiring directors are: Walter H. Moore, Arthur Langguth and L. B. French, of Portland, and A. L. Miller, of this city, Mr. Phillips still remaining on the board. The new officers are all local men. The company has on hand sufficient steel to build six miles of road. Four miles will be built within the city. M. J. Connor, the new general manager, has had seventeen years' experience on railway construction and will assume complete control at once. The line is to be built with sixty-pound steel.

OSWEGO, N. Y.—The resolution limiting the franchise of the Oswego Traction Company in East Fourth street and southerly to twenty-five years has been rescinded by the common council and in its stead a second resolution granting the company a perpetual franchise in the premises has been adopted. The franchise grant is subject to the regulations previously adopted regarding paving and construction.

BOSTON, MASS.—The Boston & Worcester Street Railway has petitioned the railroad commission for approval of the issue of $500,000 additional capital stock, making the total authorized capital stock after such increase $2,225,000. New stock is to be used for building and equipping railway extensions, power and car houses. At a recent meeting of stockholders 17,224 shares were voted in favor of the increase and none against it.

WASHINGTON, D. C.—It is announced that the Washington, Baltimore & Annapolis electric railway has secured a tract of land at the corner of Fifteenth and H streets, northeast, Washington, on which the terminal station of the road will be erected. The plans for the station will be ratified shortly and work begun within a few months. The road will be in operation early in November, according to President George T. Bishop.

ST. JOSEPH, MO.—The Missouri Traction Company has been organized to build a trolley line from St. Joseph to Excelsior Springs by way of Plattsburg, at which place the road will branch off to Mirable and Kingston. A committee was appointed to prepare incorporation papers and forward them to Jefferson City. While no statement was made as to the capital stock of the company, it is stated that it will be approximately $1,000,000.

DAVENPORT, IOWA—Amended articles of incorporation of the Davenport & Suburban Railway Company have been filed, by the terms of which the capital stock is reduced from $1,400,000 to $10,000. The lines of the company are now a part of the Tri-City Railway Company's system, but for business reasons the old company will not go out of existence at the present time and the corporation will be maintained with a capital stock of $10,000.

REDDING, CAL.—The city of Redding has granted a new franchise to the Redding & Red Bluff Electric Railroad Company to replace the one that expired by limitation. Counsel asking for the franchise admitted that his company was only subsidiary to the Northern Electric Company, which he assured the city council would build from Chico through Red Bluff to Redding as soon as its Oroville-Chico line to Sacramento was in good working order.

WEBSTER CITY, IOWA—Definite announcement is made of the success of the Boone and Webster City interurban project. It is announced that active construction of the line will begin this year and that within twelve months cars will be running. The project is to be capitalized at $600,000. The Boone electric light plant and the Boone street and suburban railway interests are to be consolidated with the interurban to run between that city and Webster City.

NORTHAMPTON, MASS.—A number of capitalists of this city, Westfield and Boston, headed by Eugene D. Parks, of Russell, announce plans for the construction of a street railway line which will open up territory lying between this city, Easthampton and Westhampton. The line, it is proposed, will extend from Easthampton to Loudville, thence to West Farms and from there to the village of Florence. A branch line will be built to Westhampton. It is a rich agricultural district.

MACON, GA.—W. J. Massee, president of the Macon & Albany Interurban line, president of the Bibb Power Company, and vice-president of the Macon, Griffin & Atlanta Interurban lines announces that work on the two car lines, and the work of constructing the big dam of the Bibb Power Company across the Ocmulgee River will commence between now and January 1. Mr. Massee states that the money has been raised, and within two years' time street cars will be plying between Atlanta and Macon and between Macon and Albany.

EVANSVILLE, IND.—The Evansville & Southern Indiana Traction Company proposes to have the extension from Princeton to Patoka, Ind., completed within sixty days. A contract for the track laying has been let by the company. The extension covers a distance of four and one-half miles and includes five bridges, the largest of which is to be over the Patoka river just outside the town of Patoka. The track work will be done by Jones Brothers, of Columbus, Ohio, and the bridges will be erected by the Lafayette Engineering Company.

BUENA VISTA, CAL.—An electric railway to tap the rich mineral district across the continental divide west of Buena Vista, known as Taylor park, will be constructed during the next twelve months according to the proposition outlined by Charles A. Reiss, a New York capitalist, at a mass meeting of Buena Vista citizens. The proposition was received with enthusiasm. An organization will be effected at once, a charter obtained and arrangements made to commence construction work within a few weeks. It is the intention of the promoters to have twelve miles of the road ready for operation by June 1, next.

ALBANY, N. Y.—The annual report of the United Traction Company has been submitted to the State Utilities Board. The report includes statistics of the Cohoes Railway Company, the Capital Railway Company, the Lansingburg & Cohoes Railway Company, the Troy & Cohoes Railroad Company, and the Waterford & Cohoes Railroad Company, all of which lines are either owned or leased by the United Traction Company. A note in the report states that all the tracks and property owned by the United Traction Company in the city of Rensselaer are leased to and operated by the Cohoes Railway Company. On December 3, 1906, according to the report, the capital stock of the United Traction Company was increased by $7,500,000 for the purpose of acquiring the Hudson Valley Railway Company. The gross earnings from operation were $1,956,441.85; operating expenses, $1,187,735.72; gross income from all sources, $860,688.64; deductions, $349,925; net income, $510,763.64; dividends, $187,485; surplus for the year, $323,278.64; surplus up to June 30, 1906, $244,361.93; profit and loss debit, $222,455.35; balance, $21,906.58; total surplus June 30, 1907, $343,185.22. The total miles of single track owned by the Hudson Valley Railway Company, 116.07; total single track owned by the United Traction Company, 42,332 miles; total, 158,402.

INDUSTRIAL ITEMS.

THE LORD ELECTRIC COMPANY, Boston, Mass., has published two very attractive bulletins devoted, respectively, to Shaw non-arcing lightning arresters, and Thomas soldered rail bonds. Copies of these bulletins may be secured upon request.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., has ready for distribution its bulletin No. 3,504, devoted to electric exhaust fans, twelve, eighteen and twenty-four-inch, direct-connected, for alternating and direct currents.

THE WILE POWER GAS COMPANY, Rochester, N. Y., is distributing catalogue A, section 3, describing suction gas producers for cheap power. This describes and illustrates the characteristics of this system, and gives some very interesting data and specifications. Copies may be secured by those interested upon request.

THE ILLINOIS ELECTRIC COMPANY, Chicago, Ill., has published a new net price list and discount sheet applying to catalogue No. 16. This covers a complete range of high-grade electric light supplies, construction material and specialties. The company has also ready for distribution special literature concerning electric heating and cooking devices, knife switches and arc-lamp material.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is receiving a great many inquiries and orders for the "Just" tungsten lamps, for which it is western distributor. The company is at present importing only the standard forty-candle-power lamp, Edison base, 105 to 120 volts. These lamps consume one watt per candle. The lamps are packed with the tip downward and shipped in a special package to assure their being kept this way while in the

hands of the transportation company, and since the adoption of this package the Central Electric Company state that reports from its customers of breakage of filament have been rare.

THE ELECTRIC APPLIANCE COMPANY, 134-140 West Jackson Boulevard, Chicago, Ill., is sending out to the trade a sample of the Allen soldering stick for immediate use. The idea is ingenious and can not fail to increase the popularity of this already staple article. On the flap sealing the envelope the following inscription is found: "For a soldering stick that holds the tin, lift up the flap and look within."

THE BRILLIANT ELECTRIC COMPANY, Cleveland, Ohio, manufacturing all types of incandescent lamps, now occupies its new factory at Conneaut, Ohio, retaining, however, its general sales offices at Cleveland, Ohio. This company has shown unusual foresight for the care of its patrons during the early occupancy of its new factory by continuing the operation of the old plant at Cleveland for some weeks after the completion of the new plant. By this it has been enabled to maintain its reputation for prompt shipments and obviate the usual delays resulting from a change of manufacturing plant, although the cost of simultaneously maintaining two factories naturally develops into a large item. The general manager, E. J. Kulas, in an interview states that the capacity of the new factory is approximately 5,000,000 lamps per annum, and that without exception it is the most modernly equipped lamp factory in the world. With these greatly improved conditions the high standard of quality of the "Brilliant" lamp can be fully maintained and every advantage is enjoyed of improving and developing as conditions in lamp-making present themselves.

THE F. BISSELL COMPANY, Toledo, Ohio, is calling attention to the "H. & H." wall case, which has a number of features of particular merit. This wall case is manufactured from cold-rolled steel 0.08 inch thick, and is approved by the National Board of Fire Underwriters. The distance between the screw holes will be found to be placed very accurately. The outlets—four in the back and two in each end—may be readily knocked out for the insertion of circular loom or wire. The ears are so fastened to the box that with a pair of pliers a workman can readily reverse the ear, and the box can then be used in new work by screwing it to the lathe and plastering over the ear and around the box. If these boxes are ordered for new work they are sent out with the ears reversed. The regular flush plate furnished with "H. & H." switches covers the switch and box perfectly. The Bissell company is also calling attention to its double-ended receptacles for window display and stage lighting for concealed wiring.

Directory of Electrical and Allied Engineering and Scientific Societies.

(Published in the Second Issue of Each Month.)

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Cosmos Club, Washington, D. C. Annual meeting, Chicago, Ill., December.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. Albert C. Geyser, 352 Willis avenue, New York city.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Dr. J. W. Richards, Bethlehem, Pa. Fall meeting, New York city, October 17-19.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Dr. Richard Moldenke, Watchung, N. J.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 29 West Thirty-ninth street, New York city. Meetings fourth Friday of each month.

AMERICAN MATHEMATICAL SOCIETY. Secretary, F. N. Cole, 50 West 116th street, New York city.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION. Secretary, J. W. Taylor, Old Colony Building, Chicago, Ill.

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AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, G. W. Tillson, Municipal Building, Brooklyn, N. Y.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, B. V. Swenson, Engineering Societies Building, 29 West Thirty-ninth street, New York city. Annual meeting, Atlantic City, N. J., October 14-18.

AMERICAN STREET AND INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, Elmer M. White, assistant treasurer Birmingham Railway, Light and Power Company, Birmingham, Ala. Annual meeting, Atlantic City, N. J., October 14-18.

AMERICAN STREET AND INTERURBAN RAILWAY CLAIM AGENTS' ASSOCIATION. Secretary, B. B. Davis, claim agent Columbus Railway and Light Company, Columbus, Ohio. Annual meeting, Atlantic City, N. J., October 14-18.

AMERICAN STREET AND INTERURBAN RAILWAY ENGINEERING ASSOCIATION. Secretary, S. W. Mower, London, Canada. Annual meeting, Atlantic City, N. J., October 14-18.

AMERICAN STREET AND INTERURBAN RAILWAY MANUFACTURERS' ASSOCIATION. Secretary, George B. Keegan, 2321 Park Row Building, New York city. Annual meeting, Atlantic City, N. J., October 14-18.

ARKANSAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles F. Speed, Texarkana, Ark.

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ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa. Meetings, second and fourth Thursdays of each month.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Claus Spreckels Building, San Francisco, Cal. Monthly meetings, San Francisco, first Thursday of each month.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall street, New York city. Board of directors meets second Friday of each month.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 154 Nassau street, New York city.

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INDIANA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. S. Norton, Indianapolis.

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MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby street, Boston, Mass. Meets second Wednesday of each month, except July and August.

MASTER CAR BUILDERS' ASSOCIATION. Secretary, J. W. Taylor, 390 Old Colony Building, Chicago, Ill.

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NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, W. W. Freeman, Engineering Societies Building, 29 West Thirty-ninth street, New York city.

NEBRASKA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. E. Mattison, Lincoln, Neb.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State street, Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl street, Boston, Mass. Meetings held on fourth Thursday of every month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 29 West Thirty-ninth street, New York city.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. Max Eaton, Niagara Falls, N. Y.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, R. N. Kimball, Kenosha, Wis. Next annual meeting, Milwaukee, Wis., January, 1908.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, O. O. Welsheimer, Columbus, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, F. W. Bullard, Cleveland, Ohio.

OHIO STREET RAILWAY ASSOCIATION. Secretary, Charles Currie, Akron, Ohio.

OLD TIME TELEGRAPHERS' AND HISTORICAL ASSOCIATION. Secretary, John Brant, 195 Broadway, New York city. Annual meeting postponed until next year.

ORDER OF THE REJUVENATED SONS OF JOVE. C. B. Roulet, Mercury, Dallas, Texas.

PACIFIC COAST ELECTRIC TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 135 South Second street, Philadelphia, Pa.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings, second Saturday of each month.

RAILWAY SIGNAL ASSOCIATION. Secretary, C. C. Rosenberg, Bethlehem, Pa.

RAILWAY TELEGRAPH SUPERINTENDENTS' ASSOCIATION. Secretary, P. W. Drew, Wisconsin Central Railway, Milwaukee, Wis. Next annual meeting, Montreal, Canada, June 24-26, 1908.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Arthur L. Williston, Pratt Institute, Brooklyn, N. Y.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, E. R. Buck, Hudson, So. Dak.

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VERMONT AND NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, G. W. Buzzell, St. Johnsbury, Vt.

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WESTERN SOCIETY OF ENGINEERS (Electrical Section). Secretary, J. H. Warder, 1737 Monadnock Block, Chicago, Ill.

WISCONSIN ELECTRIC AND INTERURBAN RAILWAY ASSOCIATION. Secretary, Clement C. Smith, president Columbia Construction Company, Milwaukee, Wis.

WISCONSIN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. C. Crowley, Jr., Superior, Wis.

DATES AHEAD.

Jamestown Tercentennial Exposition. Norfolk, Va., April 26 to November 30.

American Street and Interurban Railway Association. Annual meeting, Atlantic City, N. J., October 14-18.

American Electrochemical Society. Fall meeting, New York city, October 17-19.

Western Association of Electrical Inspectors. St. Paul, Minn., October 22-24.

American Association for the Advancement of Science. Chicago, Ill., December.

Record of Electrical Patents.

Week of October 1.

867,256. SUBAQUEOUS LIGHT SYSTEM. Léon Dion, Wilkes-Barre, Pa., assignor to Dion Submarine Light Company, Wilkes-Barre, Pa. A submarine conductor and submerged lights mark out a definite channel as an aid to navigation.

867,257. FUSE-BOX SUPPORT. James S. Doyle, New York, N. Y. A combination of fuse box and yielding support for the fuse carrier.

867,312. ELECTRIC-WIRE CONNECTOR. John A. Shutz, Richmond, Ind., assignor of one-third to Madison L. Kirkman and one-third to William H. Woolley, Richmond, Ind. A means for

connecting opposing terminal members in tandem by interlocking wedges.

867,319. ELECTRODE. John W. Stubbs, Middlewich, England, assignor to the General Electrolytic Parent Company, Limited, a joint stock company, of Great Britain. An electrical conductor in intimate contact with a mass of powdered carbon, resin and tetra-chloride of carbon.

867,320. ELECTROLYTIC PROCESS AND PRODUCT. Clinton P. Townsend, Washington, D. C., assignor to Elmer A. Sperry, Brooklyn, N. Y. A method of producing lead oxide by the electrolysis of a lead anode, producing basic and acid radicals of lead.

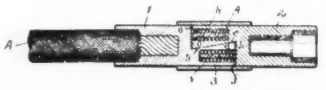
867,329. BLOCK-SIGNAL APPARATUS. Frank C. Williams, Philadelphia, Pa. A system operating signals by means of stationary plates arranged along the track, and yielding to the impact of a contact on the train.

867,331. AUTOMATIC SAFETY CONTROLLING MEANS FOR TRAINS. David S. Affleck, Chicago, Ill. A signal system adapted to set signals on the train by means of short-circuit sections in the respective blocks.

867,349. TESTING SYSTEM FOR TELEPHONE LINES. William W. Dean, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. A telephone test system in combination with the subscribers' lines.

867,355. SAFETY DEVICE FOR HEATERS. Ira Filson, Springfield, Ohio. A thermoelectric device operating an electromagnet.

867,358. ICE AND SLEET-CUTTING CONTACT SHOES. Rutherford Fullerton, Columbus, Ohio. An electromagnet brings the cutting shoe into intimate contact with the current-carrying rail.



867,312.—Electric-Wire Connector.

867,364. AUTOMATIC RAILROAD SIGNAL. William H. Harris, Stark, Mont. The signal system employs two opposing electrical circuits.

867,391. STORAGE-BATTERY PLATE OR GRID. Joseph Marx, Buffalo, N. Y. The grid comprises a compartment upon which the active material can be interchangeably superposed.

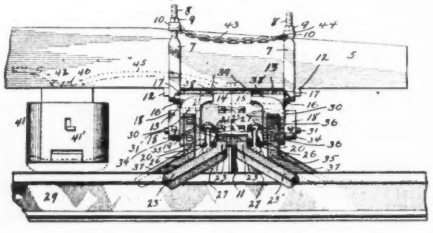
867,406. RAIL BOND. Lewis T. Pates, Upper Alton, Ill. The connector has a pair of integral prongs at each end adapted to be deflected in making intimate contact with the web.

867,415. RAIL BOND. Frank W. Richey, Chicago, Ill., assignor to General Electric Company. The body portion of the bond is attached to the terminal heads by an overlapping portion of the latter.

867,416. ELECTRICAL CONDUCTOR. Frank W. Richey, Schenectady, N. Y., assignor to General Electric Company. A stranded conductor is looped about and attached to the terminal member by a sheet-metal cap piece.

867,436. LEAD PIGMENT AND SIMILAR COMPOUNDS. Elmer A. Sperry, Brooklyn, N. Y. An electrolytic process causing deposition of metallic lead from a lead anode.

867,440. THREE-WIRE MOLDING RECEPTACLE. James S. Stewart, New York, N. Y., assignor to Annie Stewart, New York, N. Y. A socket having a combination of three-wire-two-wire connections.



867,358.—Ice and Sleet-Cutting Contact Shoes.

867,448. SIGNALING SYSTEM FOR RAILWAYS. Louis H. Thullen, Edgewood, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. The signaling system includes a source of alternating current of a frequency different from that of the propulsion current.

867,452. ELECTROLYTIC BLEACHING OF COTTON. August A. Vogelsang, Dresden, Germany, assignor, by mesne assignments, to the British Hosiery and Electrolytic Bleaching Company, Limited, London, England. The textile material is placed in bulk in the electrolyzing vat.

867,456. ELECTRODE FOR ARC LAMPS AND METHOD OF MAKING THE SAME. William S. Weedon, Schenectady, N. Y., assignor to General Electric Company. Titanium suboxide is the characteristic constituent of the electrode.

867,475. MOTOR-STARTING RHEOSTAT. Eugene R. Carichoff, East Orange, N. J., assignor to General Electric Company. The movable controlling element successively cuts out a series of resistance units.

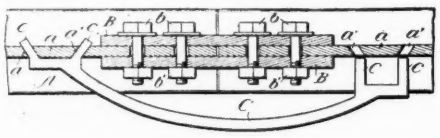
867,476. SYSTEM OF CONTROL. Eugene R. Carichoff, East Orange, N. J., assignor to General Electric Company. The current in the actuating coil of the controlling device depends upon the counter-electromotive force of the motors under control.

867,482. LOCKING MECHANISM FOR CONTROLLER HANDLES. Archibald S. Cubitt, Schenectady, N. Y., assignor to General Electric Company. The device locks the controller handle in consecutive positions.

867,486. ELECTRIC LOCOMOTIVE. Samuel T. Dodd, Schenectady, N. Y., assignor to General Electric Company. The driving effect depends upon the variation of the load and the distribution of the weight on the wheels.

867,496. FUSE. Henry Geisenhöner, Schenectady, N. Y., assignor to General Electric Company. A spring-actuated follower plugs the hole when the fuse blows.

867,509. ELECTRIC SWITCH. Edwin Johnson, Schenectady, N. Y., assignor to General Electric Company. The switch carries two sets of contacts operated by a single push-button.



867,406.—Rail Bond.

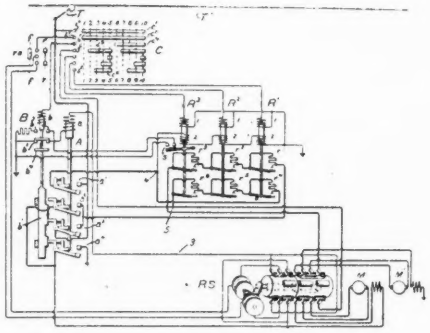
867,517. METHOD OF PRELIMINARY TREATMENT FOR ACCUMULATOR PLATES. Henry Leitner, Maybury, Woking, England. A method of preparing electrodes for secondary batteries.

867,519. ELECTRIC FURNACE. John T. Marshall, Metuchen, N. J., assignor to General Electric Company. The furnace is equipped with a number of carbon tubes for regulating the intensity of the heat.

867,522. MEANS FOR AUTOMATICALLY CONTROLLING THE SPEED OF RAILWAY TRAINS. Daniel J. McCarthy, Wilkinsburg, Pa., assignor to Union Switch and Signal Company, Swissvale, Pa. The mechanism operates a speed-controlling device, a brake-controlling valve and an energizing circuit for the operating magnets on the train.

867,542. ATTACHMENT FOR ELECTRICAL FURNACES. Samuel M. Weaver and William Ambler, Cleveland, Ohio. A combination of a heat-indicating device and support for the work.

867,543. FILLING FOR THERMAL CUTOUTS. Frederick H. Weston, Schenectady, N. Y., assignor to General Electric Company. An absorptive filling for thermal cutouts, consisting of granules or pellets of slaked lime and a binder.



867,476.—System of Control.

867,544. ELECTRIC ARC LAMP. Edward F. Winfield, Los Angeles, Cal. An arc lamp with a directive reflector.

867,547. STARTING DEVICE FOR ALTERNATING-CURRENT MOTORS. William C. Yates, Schenectady, N. Y., assignor to General Electric Company. The phases are split by the controller for different combinations of starting and running.

867,561. MEASURING INSTRUMENT. Albert G. Davis and Caryl D. Haskins, Schenectady, N. Y., assignors to General Electric Company. The measuring element rotates in one direction on a flexible suspension, and comprises means to take the twist out of said suspension.

867,563. AUTOMATIC BLOCK-SIGNALING SYSTEM. Daniel J. McCarthy, Wilkinsburg, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. An alternating-current block signaling system with normally closed track circuit.